MACHINERY

NORMA-HOFFMANN **Cartridge Bearings** End Lubrication Worries

"Cartridge" bearings are prepacked with laboratory tested, oxidation free, water resistant grease.

"Cartridge" bearings are lubricated with an exactly metered quantity of grease retained where needed — in ball raceways

"Cartridge" bearings eliminate the dangers of over or under lubrication, dirty grease or inferior grease.

"Cartridge" bearing specially designed seals are dust resistant, all metal, non-rubbing, and wearless.

Norma-Hoffmann "Cartridge" Bearings installed 17 years ago are still running with no relubrication!



NORMA-HOFFMANN

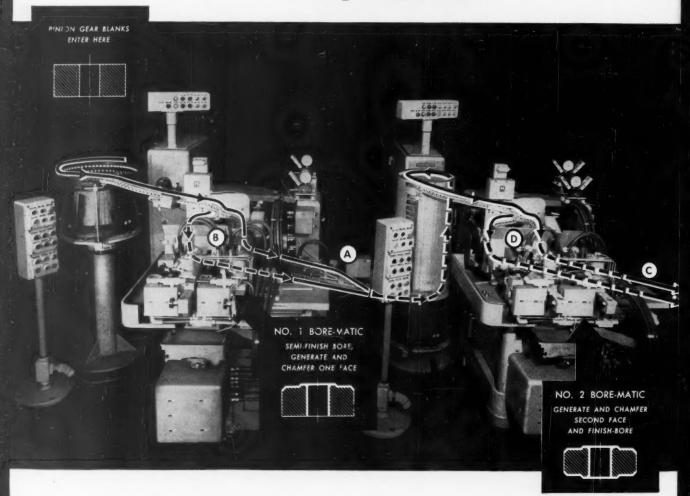
NORMA-HOFFMANN BEARINGS CORPORATION STAMFORD, CONNECTICUT . FOUNDED IN 1911

FIELD OFFICES: Atlanta

gear-blank Borizing

COMPLETELY AUTOMATED

by PEALD



THIS HEALD automated Bore-Matic installation performs every operation completely automatically—including work holding, inspection, loading, borizing, ejection, gaging, sorting and tool setting. Here's how it works.

Parts are fed from a vibrating hopper into the loading chute of Bore-Matic No. 1, where they are inspected by a "go-no-go" gage, loaded into chucks and borized two at a time to semi finish the bore and generate and chamfer the outer face. They are then fed to the gaging station at

"A" where parts are simultaneously airgaged for bore size. Gaging data from this point is fed back to the boringheads "B", automatically advancing the tool if bore is undersize or retracting it if bore is oversize. The correctly sized parts then go to the

second vibrating loader for No. 2 machine, where they are faced and chamfered on the second side and finish-bored, two at a time. At sorting and gaging station "C" they are again air gaged and boring tools at "D" automatically adjusted to correct for bore size if necessary.

This installation shows how Heald engineering and equipment fit into the modern automated production line. But no matter how much or how little automation you need.... It pays to come to Heald!

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Chicago . Cleveland . Dayton . Detroit . Indianapolis . New York

MACHINERY Editorial, Advertising and Circulation Offices 148 Lafayette St., New York 13, N. Y.

CHARLES O. HERB

Associate Editors FREEMAN C. DUSTON CHARLES H. WICK EDGAR ALTHOLZ

Assistant Editor RAYMOND H. SPIOTTA

Book Editor HOLBROOK L. HORTON

THE INDUSTRIAL PRESS **Publishers**

ROBERT B. LUCHARS President

EDGAR A. BECKER **Vice-President and Treasurer**

HAROLD L. GRAY Secretary and Publishing Manager

Advertising Representatives WALTER E. ROBINSON DWIGHT COOK 148 Lafayette St., New York 13, N. Y.

GEORGE H. BUEHLER 228 N. LaSalle St., Chicago 1, III.

NORMAN O. WYNKOOP, Jr. 15937 W. Seven Mile Road Detroit 35, Mich.

DON HARWAY & COMPANY 1709 W. Eighth St., Los Angeles 17, Calif.

MACHINERY, published monthly by The Industrial Press, Emmett St., Bristol, Conn. Executive offices, 93 Worth St., New York 13, N.Y.

Subscription Rates: United States and Canada one year, \$4; two years, \$7; three years, \$8; foreign countries, one year, \$7; two years, \$13. Single copies 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1955 by The Industrial Press.

Entered as second-class mail matter

Entered as second-class mail matter May 25, 1953, at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Printed in the United States of America.

British Address MACHINERY National House, West St. Brighton 1, England

LA MACHINE MODERNE 15, Rue Bleue Paris-IXe, France





MACHINERY

VOLUME 61

MARCH, 1955

NUMBER 7

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

Automation—the Metal-Working Industry's Philosophy for Increasing Productivity	
Importance of Cutting Tools in Transfer Machining By Ralph E.	Cross 149
Inspection Keeps Pace with Modern Manufacturing Methods By W. H.	3
Transfer Press Triples Valve-Cover Production	7 4476 102
By Herbert	Chase 196
Current Appraisal of Tooling for Automation By W. I	Bader 198
Previous Articles on Automation	203
Milling Integrally Stiffened Spars on 308-Foot Machine By C. F. W	allace 205
AACHINE AND TOOL DESIGN	
Hydraulic Systems and Electrical Controls for Automation By William C. G.	oeckel 157
Automation Costs Lowered by Standardization By E. B. V	
Electrical Requirements of a Typical Transfer Machine	
By John W. H	larper 176
Automatic Control Permits Plating Cell Selection $By T. J.$	Doyle 180
Selective Feeding Devices Increase Automation Versatility By Robert F. Glad	lfelter 188
Intermittent Rotary Movement with End-Cycle Reversal By L. K	Casper 211
Lever Type Driving Mechanism Permits Stroke and	
Dwell Adjustments By W. M. Ha	ılliday 212
Hobbing Worm-Gears on a Milling Machine By H. J. G	Gerber 214
Automatic Die Stop By Federico Str	rasser 215
American Standard Buttress Screw Threads (Data Sheet)	247
MANAGEMENT PROBLEMS AND EVENTS	
New Legislative Proposals Require Close Scrutiny	
By Loring F. Ove	erman 139
Will Automation Lessen the Need for Labor? By Charles O.	Herb 141
How to Capitalize on the Machine Tool Show By Bernard	Lester 217

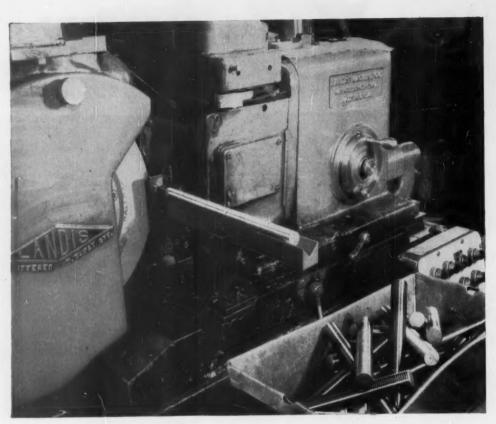
DEPARTMENTS

	LIANI	MENTS	
Keeping Up with Washington	139	Data Sheet	247
Ingenious Mechanisms	211	Between Grinds	252
Tool Engineering Ideas	214	News of the Industry	255
Talking with Sales Managers	217	New Catalogues	257
The Latest in Shop Equipment	218	Coming Events	268

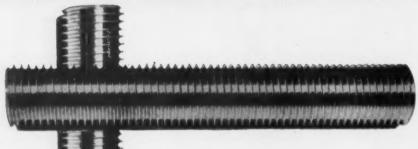
Product Directory 298



Advertisers Index 403-404



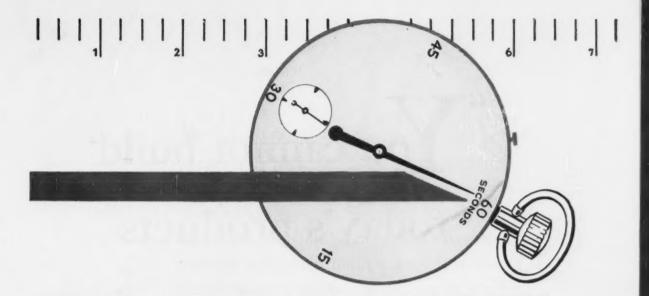








389-0



Threads 7%" per Minute by CONTINUOUS GRINDING

LANDIS Centerless Thread Grinders are being used at the Kilbourn Engineering Company in Milwaukee, Wisconsin, to produce continuous threaded studs for high-pressure high-temperature service.

Studs ranging from 5%" to 13%" in diameter are threaded from blanks of SAE 4140 steel heat-treated to a 260-320 Brinell hardness. In the operations illustrated, 11%" 8 pitch UN threads must be generated 10" long to a Class 7 fit to meet ASA standards (Manual B1.4). These threads are produced with LANDIS #1 Centerless Thread Grinders by continuous thru-feed grinding at the rate of 71/4 linear inches per minute, or better. The excellent quality and smooth finish of the ground thread has reduced final assembly time and minimized galling.

Centerless Thread Grinders, manufactured exclusively by LANDIS, are designed for the high-speed threading of a wide variety of workpieces from 1/16" to 43/4" in diameter. Blanks having one or more diameters, requiring threads on the outer diameter, can be threaded automatically by the thru-feed process used here.

Centerless Thread Grinding, by utilizing the "up-grinding" technique, is also well-adapted for threading workpieces of high hardness and coarse pitch. This process allows up to 30% higher work surface speeds, and often eliminates secondary threading passes required by other methods. For further information, send specifications and ask for Bulletin E-97.

LANDIS Machine CO. WAYNESBORD

THE WORLD'S LARGEST MANUFACTURERS OF THREAD GENERATING EQUIPMENT

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-3

"You cannot build today's products with yesterday's machines and be in business tomorrow!"

Quote from speech by Dr. W. W. Gilbert of the General Electric Company before the Machine Tool Distributors Meeting, Cincinnati, Ohio. Oct. 19-20, 1954.

We believe that Dr. Gilbert's statement is particularly pertinent to the production of precision gears in quantity. In our 1955 line are the most modern Gear Shapers . . . ready for automatic operation . . . capable of faster stock removal while working to closer tolerances. These machines can save you money by keeping gear quality up and costs down.



High Speed No. 4 GS for record-making production on work up to 6" diameter x 2"

No. 12 a high-spindle-speed, fast feed machine for all-purpose gears to 12" diameter x 4" face.

No. 36 is in wide use for coarse pitch pinions and gears in all diameters to 36"x 6" face.



New No.12

H. P.* No. 36

*High Production Clour

THE

GEAR SHAPER COMPANY

Head Office and Export Department: 78 River Street, Springfield, Vermont Branch Offices: 319 Fisher Bldg., Detroit 2 * 5835 West North Avenue, Chicago 39 * 2206 Empire State Bldg., New York 1 6214 West Manchester Avenue, Los Angeles 45

To centerless grind

parts like these

you need the NEW

CINCINNATI

Cinzinnati offers the only complete line of Conterless Grinding Machines.

CINCIN

Keeping the cost of precision grinding in line with the size of small parts is often quite a job. Now you can do something about it. CINCINNATI FILMATIC No. 0 Centerless Grinders are completely new, designed specifically for small work up to $\frac{1}{2}$ " diameter. They require but little floor space, only 63" x 61 $\frac{1}{2}$ ", yet the machine is ruggedly constructed to remove metal rapidly up to the full capacity of the 5 hp grinding wheel drive motor. ¶ There are a number of reasons why these new CINCINNATIS are such efficient, low-cost producers:



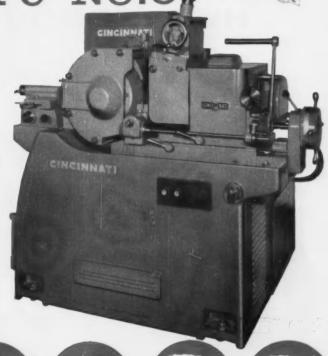
New CINCINNATI FILMATIC No. 0 Centerless Grinding Machine. Catalog No. G-640 contains complete specifications.

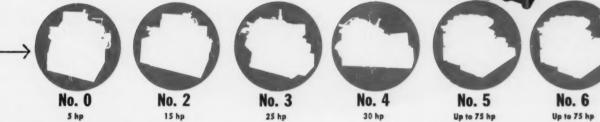
FILMATIC NO.O

- a) FILMATIC bearings for the grinding wheel spindle run for years without servicing or adjustment
- b) Double slide construction between bed and regulating wheel housing simplifies setups; facilitates infeed grinding
- c) Automatic and oil-shot lubrication
- d) Tachometer indicated, infinitely variable regulating wheel speeds

Would you like to know more about new Cincinnati Filmatic No. 0 Centerless Grinders, and how they can reduce the cost of small precision parts? Write for catalog No. G-640.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO





NATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

. . . FOR

of SMALL PARTS at
HIGH PRODUCTION RATES
THAT CUT COSTS,



Don't wait... for extra profits install a Van Norman machine now! They are available on four purchase plans — Outright sale... Purchase on conditional sales contract up to 5 years... Straight lease... Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

VAN NORMAN

MANUFACTURERS of—Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.



This outstanding centerless grinder can help you cut your grinding costs. It provides fine finish to close tolerances at high production rates. Actually three machines in one, the Diversimatic is a standard centerless grinder for throughfeed work . . . a standard centerless grinder for infeed jobs . . . and equipped with the Crush Forming Attachment, it does form grinding not possible by any other method.

The Diversimatic finish grinds small parts from solid . . . or finish grinds rough-turned parts. It grinds faster, holds tolerances, cuts costs.

CENTERLESS GRIND PARTS LIKE THESE FASTER, MORE ECONOMICALLY ON THE DIVERSIMATIO



Get the full facts on the Van Norman Diversimatic Centerless Grinder. See for yourself how this versatile grinder can cut your grinding costs on small shafts, formed shapes, parts of two or more diameters or special contours.

COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Landis automation . first in

1935 Landis automation for camshafts



matically. The year: 1935.

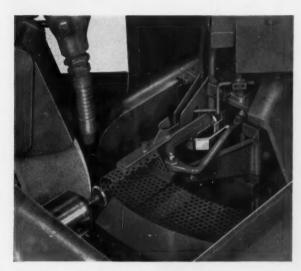
000000000 precision grinders

first in automation since 1935

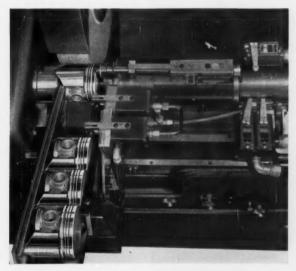
LANDIS TOOL COMPANY

cutting grinding costs automatically

TODAY Landis automation for a wide variety of work

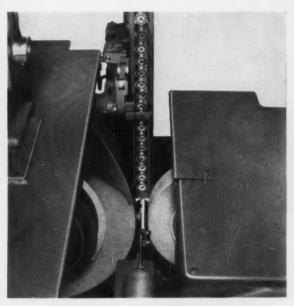


Landis automation for valves

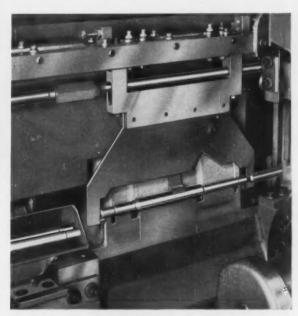


Landis automation for pistons

WAYNESBORO, PENNA., U. S. A.



Landis automation for appliance parts



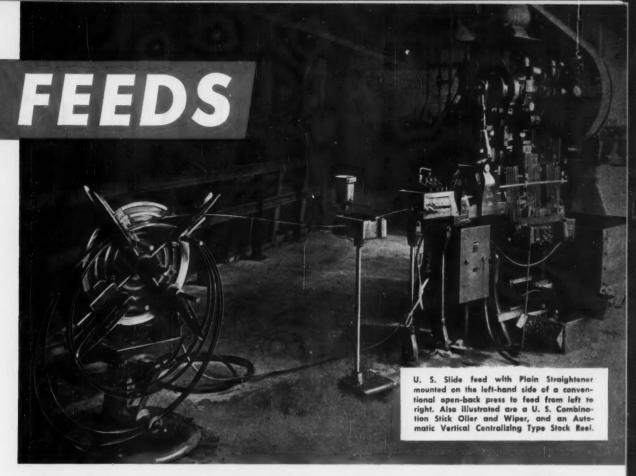
Landis automation for many other parts

U. S. SLIDE

Photo above shows a U. S.
Slide Feed with a U. S. Plain
Straightener mounted for
feeding right to left on a
press with crankshaft running from front to back, instead of left to right as on
conventional presses. Also
shown in photo is a U. S.
Automatic Coil Cradle.

Photo at left shows a U. S. Slide Feed arranged with a Two-Way Wire Straightener to feed round wire from front to back into a straight-sided press.

U.S.



Do These Jobs Suggest Answers to Your Press Feed Problems?

The illustrations on this and the facing page show U. S. Slide Feeds being used with three different types of presses. In each case the user is obtaining benefits as follows:

ACCURACY

U. S. Slide Feeds are generally recognized as the most accurate automatic feeds on the market for feeding material into punch presses. The slide block, which contains the blade to grip the material, reciprocates on hardened and ground slide rods between adjustable stops, insuring controlled accuracy of feed length.

VERSATILITY

As illustrated, U. S. Slide Feeds can be arranged for use with different types of presses for feeding left to right, front to back, back to front, etc. They can also be used for feeding different types of material in coils: steel, brass, copper, aluminum, paper, cardboard, fibre, plastic, etc., and they can be arranged for butt feeding short strips when material is over .030" in thickness and of suitable stiffness.

AUTOMATIC OPERATION

The use of a U. S. Slide Feed converts the press into an automatic machine, resulting in reduced costs and increased production. All the operator has to do is thread and start new coils of material.

If press operations are included in your production, U. S. Slide Feeds may be the answer to your feeding problems. Ask for a copy of Bulletin 80-M, which contains complete specifications.



TOOL COMPANY, Inc.

Ampere (East Orange) New Jersey

Builders of U. S. Multi-Slides—U. S. Multi-Millers

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

Why you get top savings with

The "CROWN" JEWELS"



No one disputes the fact that diamond wheels save time and money in carbide tool grinding. The big question is: which diamond wheels save the most?

There's a very logical answer. Buying diamond wheels calls for the same trust in the supplier — in his reputation for full value and expert craftsmanship — as buying diamond jewelry. And right there is where Norton's long leadership in diamond wheel development and manufacture is the best possible safeguard for your investment. In fact, only Norton offers you such long diamond wheel experience to help you produce more at lower cost.

For your further guidance, check these reasons why Norton diamond wheels are the recognized "Crown Jewels" of the entire field: Norton was first to introduce the three major diamond wheel bond types — resinoid, metal and vitrified — and has always pioneered in their advancement.

The sizing, grading and laboratory checking of diamonds used in Norton diamond wheels is done in Norton's own plant — never anywhere else.

Norton duplicates specifications for each wheel type and size with utmost accuracy for uniform top performance.

The line of Norton diamond wheels is complete, with sizes and types covering not only every carbide grinding application but every other field — stone, glass, ceramics,

electronics, etc. — where diamond wheels are used.

Norton diamond wheels for every need are quickly available from full stocks in Worcester, five strategically located warehouses and Distributor's stocks.

See your Norton distributor

for further facts on Norton diamond wheel performance and applications. Ask him for the 142-page illustrated booklet, *Grinding Carbide Tools*, and the complete net priced Diamond Wheel Catalog. Or write to Norton Company, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone directory, yellow pages. *Expert*: Norton Behr-Manning Overseas Inc., Worcester 6, Mass.

Norton Diamond Wheels...

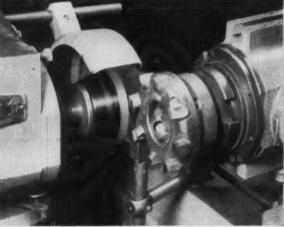
for carbide grinding



For Top Savings In Production Grinding of single point carbide tools, use Norton vitrified bonded diamond wheels. Combining fast cutting action with high resistance to grooving, they're often preferred for grinding chip breakers and for precision grinding (cylindrical, surface and internal) of carbide tools, cutters, thread gages, rolls, etc. This Norton engineered bond holds each diamond particle for maximum useful cutting action and long, money-saving wheel life.

For Top Savings On Especially Severe Single Point Tool Grinding and where long life is most important, Norton metal bond diamond wheels are recommended. They're also most economical for many other jobs — such as cutting-off sintered carbide blanks, glass, ceramics, germanium and stone.

Making better products . . . to make your products better



For Top Savings In Multi-Tooth Grinding, Norton resinoid bonded diamond wheels hold size completely around cutter after cutter, assuring uniform height to each individual cutter tooth. Their extra fast cutting action and long service life are big advantages in precision sharpening. Two bond types available—regular, for maximum economy in wet grinding and B6, for best results in dry applications.



W-1610



and its BEHR-MANNING division

NORTON: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-15

BALANCED Ition

Lowers the Cost of Tapped Holes

> Winter Taps perform with BALANCED ACTION, giving you very high hole-accuracy with long tool life. Only Winter makes BALANCED ACTION TAPS.

GAGES by WINTER

Like Winter Taps, this new line of Gages is manufactured with extreme care. Winter's BALANCED ACTION principle means the utmost in accuracy. . . . Catalog on request.



PHONE YOUR WINTER DISTRIBUTOR

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago Dallas • San Francisco • Los Angeles

> Division of National Twist Drill & Tool Co.

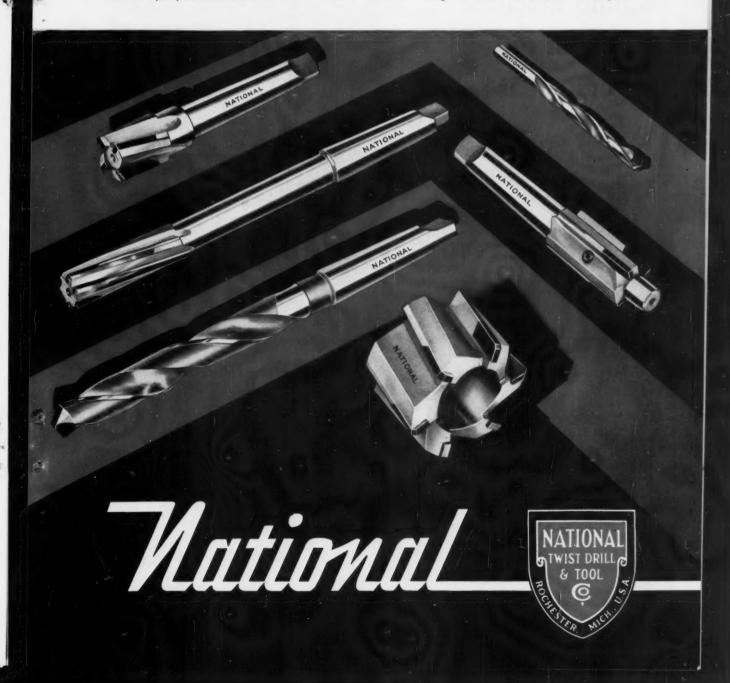
Amouncing Carbide Tipped Tools

Now available: National Twist Drills, Reamers, End Mills, Milling Cutters, and Counterbores with carbide tips.



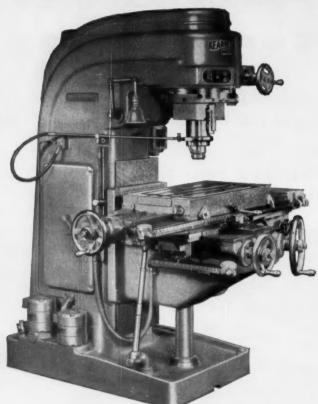
NATIONAL TWIST DRILL AND TOOL COMPANY, Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles



FOR RENT: one new machine

That's all you pay for this new Model 2D Rotary Head milling machine when put to work in your plant with...



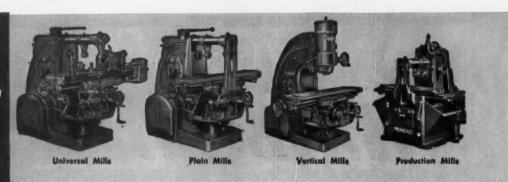
For additional data on this machine, see our catalog in Sweet's.

Kearney & Trecker's

TOOTHASE

PROGRAM

Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.



COST: only 44 cents per hour

LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE SHIPBUHDING AND ORDNANCE INDUSTRIES

Includes machines for shipbuilding; forgings; foundry machine shops; die castings; pipe fabrication; ordnance, including

atomic energy, small arms, guns, gun carriages, ammo, fuses, explosives, fire-control instruments, tanks; steam engines, turbines and waterwheels. Of the total 27,216 machines, 12% are over 20 years old and over 48% are 10-20 years old!

Machines over 20 years old, which should definitely be replaced.

Machines 10-20 years old, which should probably be replaced.

44%

Machines less than

55%

5526 automatic and manufacturing type milling machines

7131 vertical milling machines

8722 knee type horizontal milling machines

3561 bed type milling machines

2276 horizontal and vertical precision boring machines

47	50%	36%
13%	45%	42%
19%	45%	36%
6%	63%	31%

HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

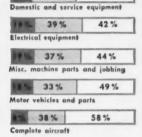
Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.

20%	26%	54%
Agricult	ural equipr	neni
II.	33%	44%
Const.,	mining and	oil well equip
22 %	32%	46%

18%	35 %	37 %
Special i	ndustry mac	hinery
200	33%	45%

115 27% 41%

Office and store machines



39%

opellers & pa
30%
30 /4
46 %
oducts
38%
nce and misc.
52%

Figures adapted from 1953 American Machinist survey of metalworking industry

THIS new Model 2D Rotary Head milling machine costs you only 44 cents per hour . . . installed and in operation in your plant. It's amazing. But under Kearney & Trecker's Tool-Lease Plan "A," one of three possible lease agreements, you make two semi-annual payments, totaling 25% of the machine's price during each of the first three years. And only 10% during each of the last four years.

What's more, you benefit from Model 2D's many

What's more, you benefit from Model 2D's many time-saving operating features. The Rotary Head design assures greater accuracy and savings because you can do precision boring, drilling, slotting and milling of circular and angular cuts in both horizontal and vertical planes—without changing the setup.

Under Tool-Lease you can rent any of over 250 different types and sizes of standard milling machines or precision boring machines. All are avail-

able under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

For complete information on Tool-Lease, see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



Rotary Head Milling Machines



Autometric Precision Boring Machines

KEARNEY & TRECKER CORP. 6784 W. National Ave., Milwaukee 14, Wis. Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence."

	Ber
	edite:
Space & Southern	of Cases
PROGRAM	SE
1 155	-
-	-

Title.....

.

Company..

Address....

City.....

Zone State....

HOW A HARDER GRADE ABRASIVE INCREASED DISC LIFE 10 TIMES

The Problem

An ordinary type of segmental disc had to be replaced after snag grinding only 51,000 automobile cylinder blocks on a Gardner Horizontal Disc Grinder. The short disc life caused high abrasive costs and interruptions to production.

The Solution

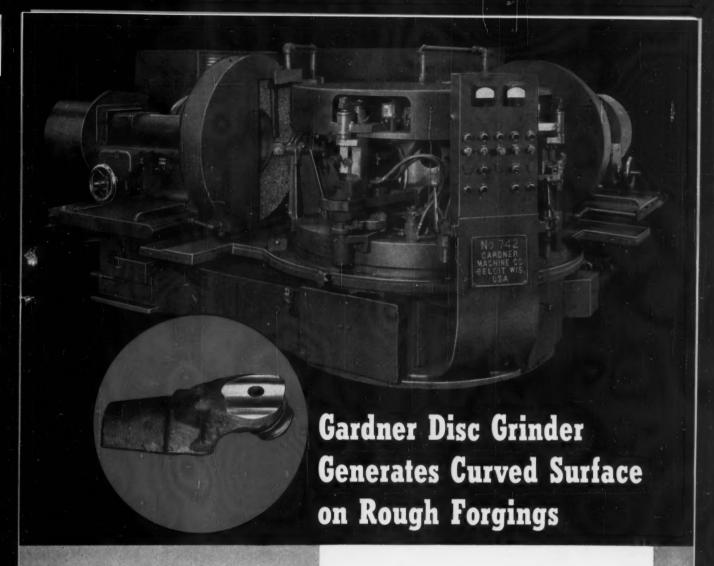
The Gardner Abrasive Specialist recommended a YELLOW-RIM*segmental disc of a much harder grade. This new disc has already ground more than 250,000 cylinder blocks and is expected to grind 250,000 more in the next two years.

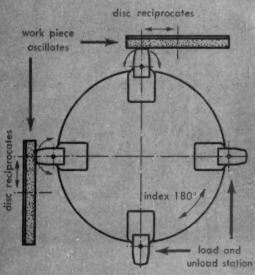
If you encounter problems in flat surface grinding Gardner Abrasive Specialists can help you solve them. They have experience gained from making both the grinding machines and the abrasive discs.

For help with your grinding problems, consult the Gardner Abrasive Man.

GARDNER

precision disc grinders
BELOIT, WISCONSIN, U.S.A.





Job Data

MACHINE Gardner No. 742-42" Grinder.

TOOLING Hydraulic work table automatically indexes and fixture oscillates work across

dexes and fixture oscillates work across heads; work hydraulically clamped.

PART Rock bit heads ranging from 3%" to 15" in size; steel forgings.

in size, steel lorgings.

OPERATION Grinding radius on heads.

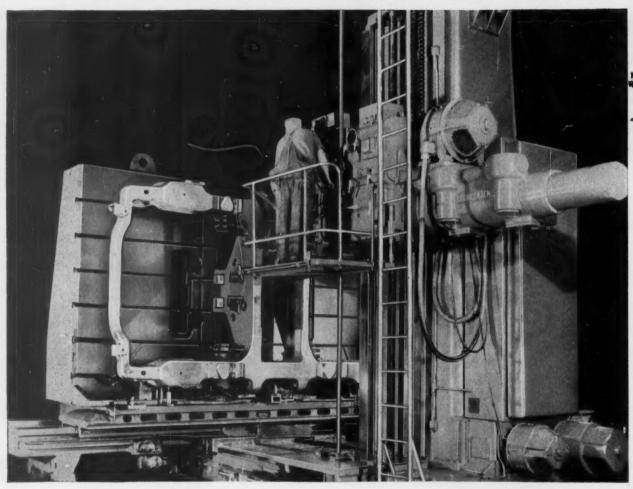
STOCK REMOVAL Up to 5/16"—in one cycle.

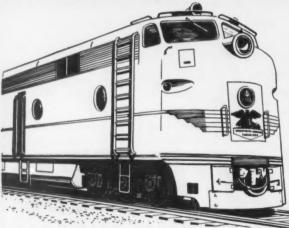
ABRASIVES Two Gardner 42" Yellow Rim WIRE-LOKT® Discs.

GARDNER

precision disc grinders
BELOIT, WISCONSIN, U.S.A.

How Giddings & Lewis build better trucks for





This Giddings & Lewis Model 570-T (Table-Type) Horizontal Boring, Drilling and Milling machine (7" diameter main spindle), equipped with a heavy-duty angular milling attachment, is used to mill bolster wear plate pads on a four-wheel Diesel locomotive truck. The large steel casting is held exactly in place by a 16' x 10' angle plate fixture.

machines help modern locomotives

The Locomotive Finished Material Co. uses Giddings & Lewis 50 Series Horizontal Boring, Drilling and Milling machines and Vertical Boring Mills to turn out precisionmachined, high quality iron and steel castings for all types of industry

Widely recognized for quality that pays off on the job - the iron and steel castings made by The Locomotive Finished Material Co., Atchison, Kan, serve in locomotive trucks. gyratory crushers and other products. Giddings & Lewis 50 Series Horizontals (table and floor types), and Vertical boring machines contribute to this precision and quality. Illustrated here are only a few of the many operations - boring, facing, slab milling, turning - which these machines perform in a single set-up.

Rugged in design, the G&L's are engineered to cut out elements of non-productive work such as extra set-ups. What's more, they maintain close-tolerances and permit greater flexibility in the choice of feeds and speeds. When equipped with underarm spindle support, angular milling attachments, continuous feed facing head, rotary table or other attachments, these machines enable you to do a variety of intricate operations. Without the above features, many of these operations would require a series of special set-ups and, in many cases, special machinery with different sequence of

If you want to solve high-cost heavy machining problems, there's a G&L machine that can do the job better and at lower cost. For prompt assistance, see your nearest Giddings & Lewis representative, or write direct.

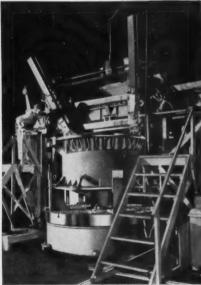
Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines - table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

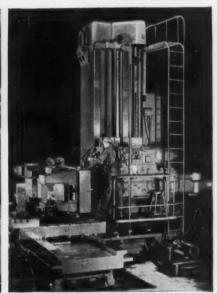


GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN



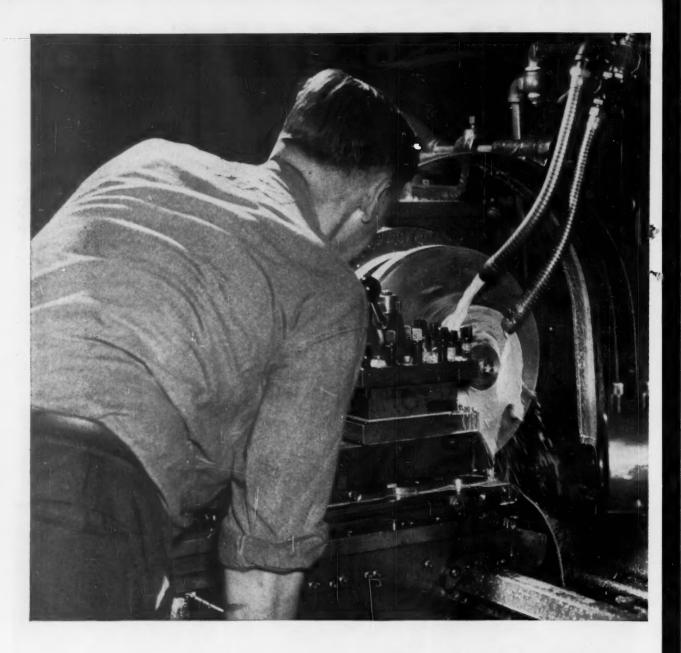




This Model 570-F Horizontal Boring, Drilling and Milling machine performs 36 operations in two hours. Inside faces and heel of the pedestals on the Diesel locomotive truck are slab milled. Work is mounted on a large rotary table that moves 12' at right angles to column runways.

Giddings & Lewis Heavy Vertical Boring mill with 10' table and 84" rail clearance is used for a variety of machining opera-tions on large and small castings. Here it's boring an adjusting ring seat on a heavy-duty gyratory crusher housing.

This Model 560-T Horizontal with a 6" dia. spindle is shown cutting an automatic feed slide on a shell press base. Equipped with a 5'x12' table with a 12' travel and headstock with 10' vertical travel, this is an excellent machine for boring and facing intricate surfaces.

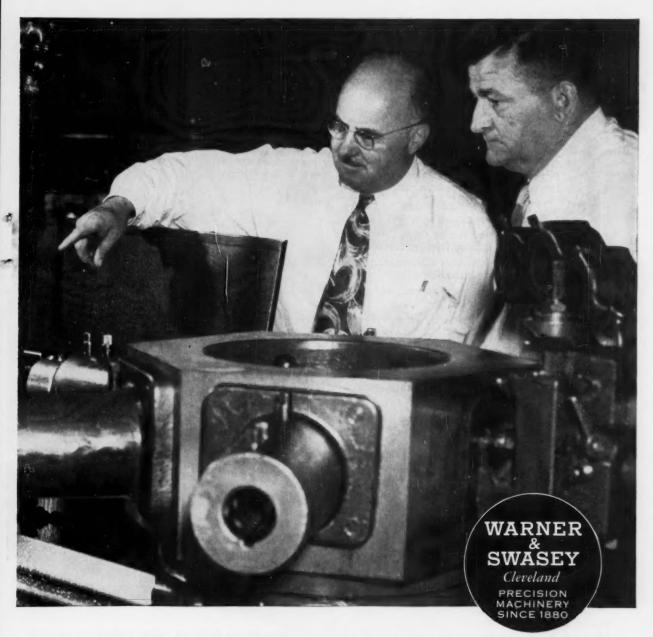


Built right-Sold right

• Warner & Swasey Machine Tools have established enviable records for high productivity, low maintenance and minimum downtime. They've proved their dependability—holding their accuracy for years after they have paid for themselves. They're built right!

Warner & Swasey's principle of design plays an important role in this success. Each model is individually designed – from the floor up—to handle a specific range of work. Machine handling time is thus minimized.

Skilled craftsmen, working to exacting



Warner & Swasey standards, combine the most modern machines and processes with certain time-honored hand techniques . . . so necessary to insure the traditional Warner & Swasey accuracy.

And Warner & Swaseys are sold right! By turning specialists who follow a rigid Warner & Swasey policy—that they recommend and sell a machine only when it completely fulfills the requirements of your particular work.

These turning specialists are also at your service long after the order is written. Your

nearest resident Field Representative, one of 47 located throughout the country, is quickly available to you. He's ready to lend his training and experience to help you maintain the high productivity of the Warner & Swaseys in your plant.

So whatever your turning needs-whether it's a machine for a specific job, or if you're

looking for greater production through modernization
. . . call in your nearest
Warner & Swasey Field
Representative.



SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

NEW CINCINNATI

make quick work of your heavy

You'll see costs tumble down when you assign your heavy duty milling operations to new Cincinnati HyPowermatics. They have the capacity to remove metal quickly; they have new control features that help the operator turn out more work with no increase in effort. Reasons why are numerous:

- 1) Infinitely variable table feed rates, 1/4" to 150" per minute
- 2) Hydramech table drive...assures uniformly smooth feeding motion
- Built-in backlash eliminator...for downmilling and up-milling jobs
- 4) Automatic spindle stop...reduces occupational hazard
- 5) Automatic two-way table cycles
- 6) J.I.C. hydraulic and electrical standards
- Unit type construction, two styles and 42 sizes of each of plain and duplex styles ...an extra wide selection to fit your requirements

Eleven additional highlights of design and complete specifications for all HyPowermatics will be found in new catalog No. M-1871. Ask for a copy today...compare...and you'll see why CINCINNATI HyPowermatics can make quick work of your heavy duty milling operations.

THE CINCINNATI MILLING MACHINE CO...
CINCINNATI 9, OHIO



CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES

BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID



Convenient, compact grouping of operating controls reduces fatigue. HyPowermatic design will make a big hit with your operators.



Hardened and ground table ways and square gib construction add their share to HyPowermatic's high cutting capacity.



Chip catcher bed design keeps the floor clean. Chips and cutting fluid stay where they belong, within the bed.

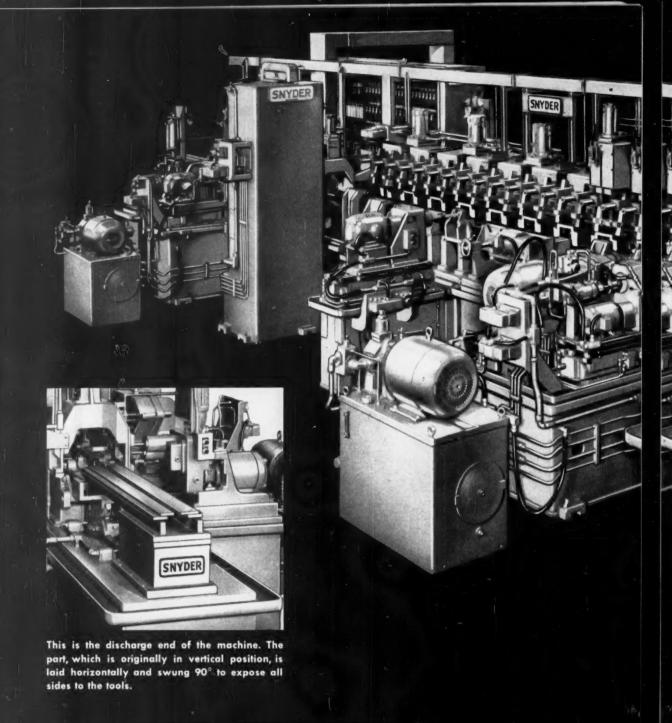
HyPowermatics

duty milling operations



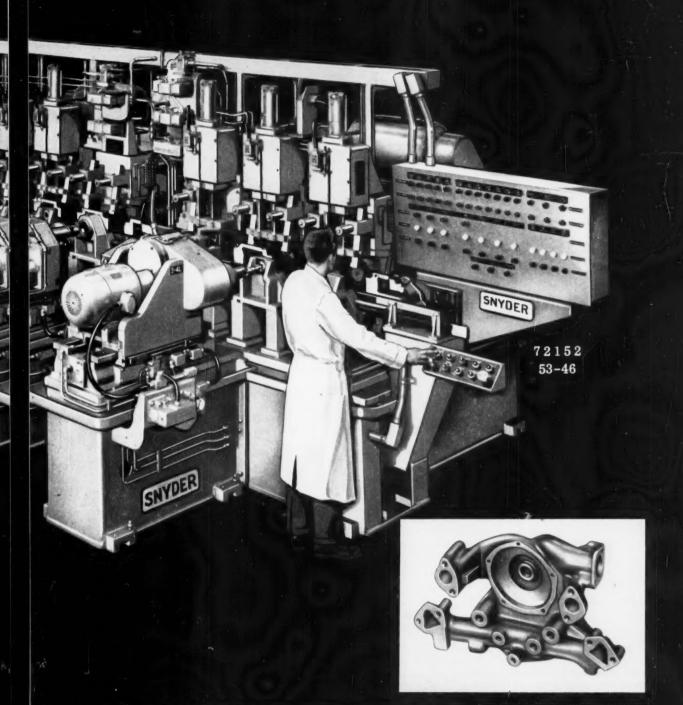
For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-27



SNYDER SPECIAL automatic

24-station transfer machine for processing automotive water pump housings; drills, mills, faces, chamfers, taps all holes and probes tap drill holes. Production, 81 pieces an hour at 80% efficiency.



SNYDER

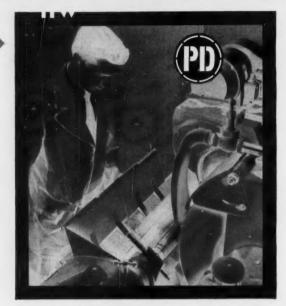
TOOL & ENGINEERING COMPANY
3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

30 Years of Successful Cooperation with Leading American Industries

A manufacturing achievement that can save you money

Just as a NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a . . .





... POSITIVE DUPLICATION of an original grinding wheel each and every time through the CINCINNATI (PD) Manufacturing Process.

NOW!

Cincinnati Grinding Wheels offer



If your plant uses grinding wheels, then you'll certainly want to investigate Positive Duplication without delay. For here is an outstanding development in precision manufacturing and quality control that can save you money . . . and increase your production!

Through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel every time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS are priced no higher than ordinary wheels.

We'll be happy to prove to you how CINCINNATI (PD) WHEELS can save you money and increase your

production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



For more information on products advertised, use Inquiry Card, page 257

5+4:100%

An Announcement of Special Interest to All Metal Cutting Plants by the Cincinnati Milling Products Division, The Cincinnati Milling Machine Co.

We are pleased to announce that the addition of four new members to the Cimcoolo family of five products now permits us to serve industry 150%.

As you know, it was just a few years ago that we introduced our first cutting fluid, Cimcool Standard Concentrate. Born of 25 years of painstaking research and practical experience, this revolutionary coolant is today the largest selling chemical-lubricant cutting fluid in the world.

In recent years we have added four other products, each one uniquely designed to serve a special purpose in industry: Cimcool Water Conditioner for increased rust control . . . Cimcool Tapping Compound, the magic compound that increases tap life . . . Cimcool S-2 Concentrate for heavy duty use . . . and Cimcool Transparent Grinding Fluid, developed for superior rust control at high dilutions.

These original five members of the Cimcool family served 85% of all metal cutting jobs. However, our goal has not been 85%, but one hundred per cent. And now, we have at last reached that goal with the introduction of four new products—which also have been developed in the laboratory and proved on-the-job:

CIMCOOL "CI"—The cutting fluid for cast iron with exceptional rust control properties.

CIMCOOL MACHINE CLEANER—2-phase non-corrosive cleaner that cuts grit, dirt, slime, oil.

CIMCOOL BACTERICIDE—The most effective agent yet developed to overcome rancidity.

Our representatives will be happy to give you full details about these nine great products now serving industry 100% . . . and to prove to you, through actual demonstration, that Cimcool products lower costs . . . and do a better job.

*Trade Mark Reg. U.S. Pat. Off,

CIMCOOL Cutting Fluids for 100% of all metal cutting jobs

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-31

WARNING

SHEARCUTTER THREAD BROACHES

GIVE AMAZING RESULTS

THEY USUALLY:

END TAPPING TROUBLE.

PRODUCE PERFECT THREADED HOLES
BY A TRUE SHEARCUTTING METHOD.

ARE PRACTICALLY UNBREAKABLE.

REQUIRE LESS THAN HALF THE POWER REQUIRED FOR TAPPING.

DO NOT BIND OR SEIZE IN THE HOLE
HAVE AN AMAZING LONG LIFE.

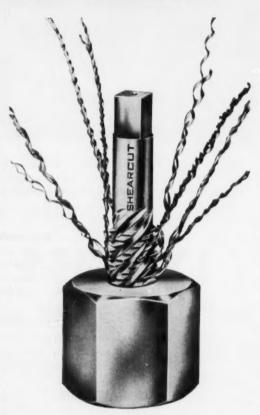
MAY BE SHARPENED MANY TIMES.
FEED THE CHIPS OUT OF THE HOLE.
TEND TO BE SELF-SHARPENING.

DO NOT TEAR THE MATERIAL BEING
CUT.

ARE MADE FROM THE FINEST H.S.S.
ARE PRECISION GROUND FROM SOLID
AFTER HARDENING.

AFTER HARDENING.
LOWER PRODUCTION COSTS.
PREVENT SCRAPPED PARTS.
LOWER TOOL AND LABOR COST PER
THREADED HOLE.
REPLACE STANDARD TYPE TAPS.

SHEARCUTTING THREADS IN
BLIND HOLE
NOTE THE CONTINUOUS ONE-PIECE
CURLED CHIP BEING FED OUT
OF THE HOLE



WARNING

DO NOT OPERATE STANDARD SHEARCUT THREAD BROACHES FASTER THAN THREE TIMES NORMAL TAPPING SPEEDS.

DO NOT OPERATE SUPER SPEED THREAD BROACHES FASTER THAN SIX TIMES NORMAL TAPPING SPEEDS.

DO NOT OPERATE ULTRA SPEED SHEARCUT THREAD BROACHES FASTER THAN TEN TIMES NORMAL TAPPING SPEEDS.

For further information write:

SHEARCUT TOOL COMPANY

7045 Darby Avenue

Reseda, Calif.

Practically Every Large Company in the United States is a User of Shearcutter Tools.

NOTE THE TRUE SHEARCUTTING

FACES (All Shearcutter Tools are

protected by U. S. and foreign patents, granted, pending or ap-

plied for.)

Production Pointers from



TIME-SAVING IDEAS



GISHOLT

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

GISHOLT JETRACER SIMPLIFIES CONTOUR BORING OPERATIONS

Low-cost Unit Added to Late Model Saddle Type Turret Lathe

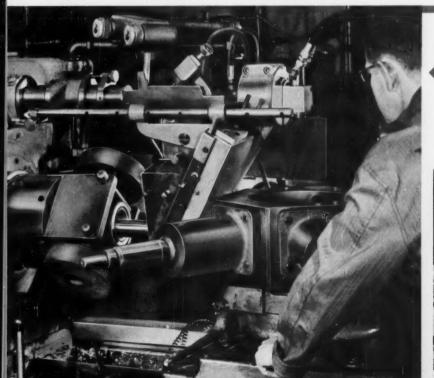
How to get still more production and lower costs out of present equipment? Mission Manufacturing Company, Houston, Texas, can show you a good example in the machining of steel valve bodies.

The time and money saver is a hydraulic tracer unit, added to a Gisholt 3L Saddle Type Turret Lathe. Operation of the turret-mounted JETRACER is simple. The entire unit, including template, is self-contained and mounted on a single face of the hexagon turret. This in no way restricts use of the overhead pilot bar.

With the Gisholt JETRACER, production has been increased 25%. A low-cost, standard, single-point tool replaces expensive special sizing tools. Considerable time is saved on

gauging, since only one diameter needs to be checked. Uniform quality is an added advantage automatically achieved, because the chance for human errors is done away with in boring operations.

New ideas pay off handsomely: Increased output plus repetitive accuracy in difficult boring operations result from this turret-mounted Gisholt JETRACER.



Note template and stylus which follows contour for boring operation.

Typical workpieces, rough and finished, handled in this setup.





TIME-SAVING IDEAS

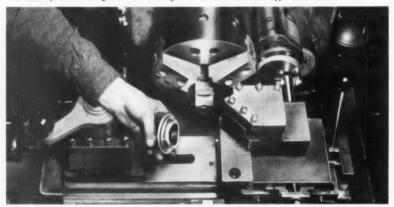
WAVE FACES EASILY GENERATED WITH THIS SLIDING TOOL BLOCK SETUP

Simple Solution to Unusual Job on a Ram Type Turret Lathe

Talk about tricky shapes to generate, look at this lug insert forging. Yet it's easily done with this setup on a Gisholt No. 5 Ram Type Turret Lathe.

For chucking there is a springloaded locator in the spindle for correct radial location on the rib on the back of the part. Tools on the hexagon turret drill, bore, co-bore, rough turn, undercut and chamfer.

This close-up shows sliding tool block arrangement on the No. 5 Ram Type Turret Lathe.



The problem surfaces are generated by tools in a special sliding tool block on the rear of the cross-slide. The block is actuated by a cam which rotates in time with the spindle. A spring-loaded roller attached to the sliding tool block follows the contour of the face of the cam, causing tools to perform contour machining on the workpiece.

Expert tooling with sliding tool block arrangement and the use of the right machine give a low 4.3-minute f. t. f. time including this unusual facing job.

LARGE CRANKSHAFTS SUPERFINISHED WITH LOW-COST LATHE ATTACHMENT

Better Wearing Surfaces Achieved Without Adding Extra Operation

To get the longer bearing life demanded of crankshafts in today's higher speed diesel engines, this manufacturer uses Superfinish...and at a minimum of equipment cost.

The main and crankpin bearings are turned on a lathe to .001-inch tolerance. Then, without removing the crankshaft from the lathe, a Gisholt No. 4 Superfinishing Attachment, which has been substituted for the front tool post, is used to Superfinish these vital surfaces down to 10 micro-inches RMS. The required micro-inch surface finish is produced without an intermediate grinding operation.

You can see the savings in time and equipment by this setup. The quick Superfinishing operation exposes true base metal so that the crankshaft operates on harder, smoother bearing surfaces for a longer trouble-free service life.



With Superfinisher attachment mounted on the lathe, machining and Superfinishing jobs are done in one chucking.

Finer bearing surfaces and improved geometry by Superfinishing make these crankshafts better performing—at less cost than former finishing methods.

Helpful Catalog, recently printed, gives explanation of Superfinish and shows many applications. Write for your copy.

Your New Machine Tools— Cash?...On Time?...Lease?

What's the most practical way for you to obtain new machine tools? You have a choice of several plans... all clearly explained and illustrated with examples in this new bulletin. Ask for your copy of Form P-1173, "What You Should Know About Buying and Renting Machine Tools."





HOW BRAKE DRUM OUTPUT WAS INCREASED 50%

Precision Taper Boring Extra Benefit of Fastermatic Automatic Turret Lathe

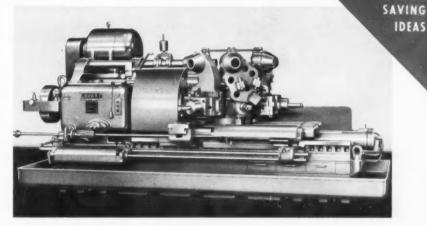
Greater output and greater precision were the objectives when refiguring this job...machining road grader brake drums.

The job is now handled on a Gisholt 4F Fastermatic Automatic Turret Lathe. This is equipped with special jaws to compensate for uneven chucking surfaces and hold the drum rigidly for the multiple cuts.

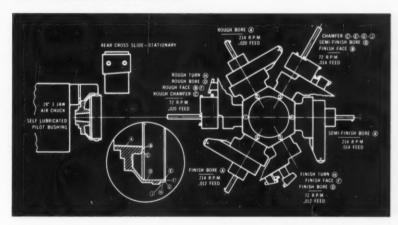
Taper boring (A) is done with a boring bar and cutter mounted in a turret facing slide tool. Three of these slide tools are used with a special cam block mounted on the stationary rear cross-slide which guides the spring-loaded slide tools along the taper angle of the bore. Result is precision gauge fit every time. These slide tools are alternated on the turret with other standard tools which bore, face, chamfer, and turn other sections of the drum.

The large parts are completed in 23.1 minutes—a 50% reduction in f.t.f. time of the former method.

The Fastermatic has the right combination of rigidity, accuracy and automatic features to provide important time- and labor-savings on this job.



Gisholt 4F Fastermatic Automatic Turret Lathe



EASIER CALIBRATION SPEEDS BALANCING OPERATION

Amount of Required Correction Directly Indicated on Gisholt DYNETRIC Balancers

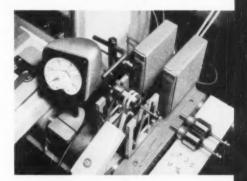
Production balancing of universal motor armatures is generally at a rate of 125 parts per hour, including measurement, correction and inspection. Fast, accurate, easy-to-operate equipment is a necessity.

This manufacturer uses a Gisholt OSB Bench Balancer to dynamically balance every armature. Six different sizes of extruded aluminum strip are used to correct for balance. The direct reading amount meter, calibrated so that one unit represents the smallest strip, quickly indicates which of the

six sizes must be used to produce balance.

It takes only 15 seconds in this case to determine accurately which strips are to be used and the positions in which they are to be placed at each end of the armature. Can you imagine anything easier?

Gisholt Balancing Machines offer many fine features which add up to quick, accurate, low-cost balancing operations. Ask for your copy of new general balancing catalog, No. 1109-A.



TIME-





TIME-SAVING IDEAS

(Right) Tooling for one type cutter bit. Photos above show pre-set tooling for two other types.

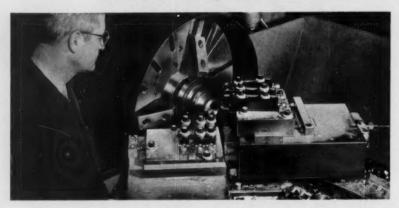
Here three different types of steel oil well cutter bits, each in two sizes, must be handled. Good reason for carefully planning changeover.

The solution is nicely provided by a Gisholt Simplimatic Lathe and pre-

TIP FOR FAST CHANGEOVERS... PRE-SET TOOLING LIKE THIS

How a little extra planning saves a lot of money

-with the Gisholt Simplimatic Automatic Lathe



set tooling. Each type of cutter bit has its own tooling which is set before being mounted on the tool slides. Special tool bits are bolted in milled slots on steel spacer plates. These are then mounted on the slides. The Simplimatic's front and rear slides have swivel bases to facilitate correct angular adjustment. Time for workpieces shown in photos is only 2.40 minutes.

Changeover with pre-set tooling on the Simplimatic saves time in handling these six different workpieces.

SPECIAL TOOLING COMBINES TWO OPERATIONS IN ONE CHUCKING



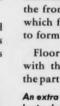
Headstock-mounted slide feeds tool at 45 degree angle to form grinding relief. (tailstock retracted to show tooling)

Rough and finished workpieces showing surfaces machined in this operation No. 12 Hydraulic Lathe Uses Auxiliary Slide to Form Grinding Relief

How to finish these steel turbine converter hub forgings in one chucking with a minimum of special tooling?

First, the work is chucked in the splined I.D. on a special splined mandrel, the end of which rotates slightly off-center to grip and drive the part. A tailstock provides additional support.

Tooling on the front carriage and rear independent slide finish turns the two hub diameters, finish faces



the flange and sizes the pilot diameter. Since the front carriage and rear slide are used for standard machining operations, they are not available for forming the grinding relief between the hub diameter and its adjacent face. Instead, a headstock-mounted auxiliary slide is used. Movement of the front carriage actuates this slide which feeds in at a 45 degree angle to form the grinding relief.

Floor to floor time is only .4 minute with the auxiliary slide permitting the part to be finished in one chucking.

An extra operation is saved by this relatively simple auxiliary slide arrangement on the No. 12 Hydraulic Automatic Lathe.





THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.



GISHOLT

Madison 10, Wisconsin

TURRET LATHES . AUTOMATIC LATHES . SUPERFINISHERS . BALANCERS . SPECIAL MACHINES

Taps or drills

over a million

different
hole combinations

The NEW



ETTCO-EMRICK Flex-Shaft Adjustable Spindle Multiple Head





IT DRILLS — IT TAPS. Takes only a moment to change from one operation to the other. Its 1:1 drive ratio is ideal for lead screw tapping.



EXCLUSIVE FLEXIBLE SHAFT SPINDLE DESIGN assures rapid, accurate setting of spindles even while unit is running.



INTERCHANGEABLE FLEXIBLE SHAFT SPINDLE DRIVES developed especially for tapping and drilling, can be run at top speed in either direction without danger of unravelling . . . without whip or vibration . . . can be removed in seconds.

- The exclusive flexible shaft drive spindle design makes this new unit the most versatile and most easily adjusted head ever offered. Once you see it, you'll appreciate why it's just what the doctor ordered for stepping up production and slashing costs on an unlimited variety of small parts tapping and drilling jobs. It's virtually a complete production line — all in one compact, lightweight, lowcost unit.
- Ingenious flexible shaft spindle design with quick adjustment feature on each of its 6 spindles gives a wider range of settings — cuts set-up time way down.
- The only head of its kind that will tap or drill on any drill press without the use of a reversing motor.
- Can be used horizontally or vertically on any standard tapping or drilling machine.
- Needs no special engineering or tooling you can put it to work on your jobs at once!
- Capacities up to 5/16".
- Unconditionally guaranteed to do the job for which it's sold you can't lose!

BIG savings in time and costs are yours the very first day you use this revolutionary new head. Why not take advantage of these savings NOW? Call your nearest Ettco-Emrick Distributor for details and prices...or write us direct.

For details in print, write for Bulletin 600

ETTCO TOOL CO., INC. 592 Johnson Ave., Brooklyn 37, New York

Etter-Emrick

Chicago • Detroit • Menlo Park, Calif. • Worcester Distributors throughout the U.S. and Canada

TAPPING ATTACHMENTS . MULTIPLE HEADS . TAPPING MACHINES . INDEXING FIXTURES . TAP AND DRILL CHUCKS

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-33

the NEWEST : BULLARD

member of a HORIZONTAL BORING MILLING and DRILLING MACHINE

PENDANT CONTROL

Complete machine control
from a movable station for feed
and speed selections,
directional feed and traverse for
Spindle, Head, Table and Saddle



Additional Features ...

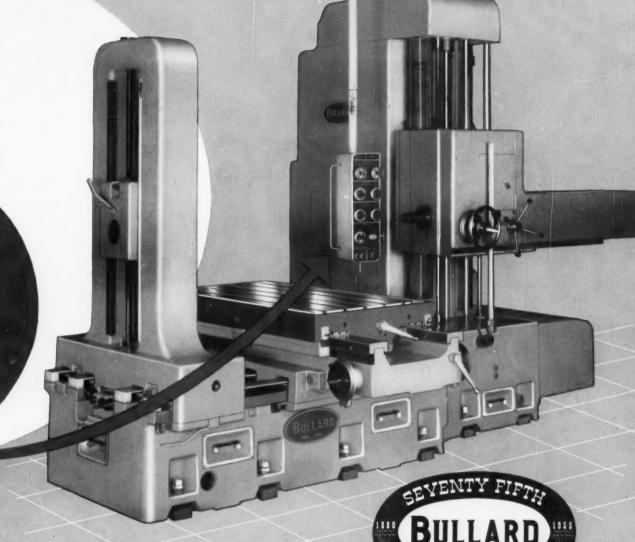
Both Screw and Rack Feed to the Spindle

Massive 4-Way Bed, Head, Headpost and Rear Post for rigidity

Spindle Speed up to 2000 R.P.M.

Replaceable Ways, chrome hardened, on Bed and Saddle Optical measuring equipment for head and table (optional) For Full

Famous Family



BULLARD ANNIVERSARY

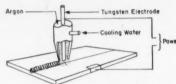
Information call your nearest Bullard Sales Office, or Distributor or write

ULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT



Sound Welds in 33 Seconds ...by HELIARC Welding



Each of the six appendages of these 52S aluminum aircraft manifolds is Heliarc welded to the tubular main section in from 20 to 45 seconds . . . The spatter-free, flux-free Heliarc welds need no cleaning or finishing—costs are kept at a minimum.

The parts are aligned in a special jig, and tack-welded in position using a lightweight Heliarc HW-9 torch . . . The finished welds are made while the parts revolve on an electrically operated turntable controlled by a footswitch. Since each weld is completed in less than a minute, production rates are high . . . Here are some of the advantages of Heliarc welding:

• Joins nearly all commercial metals including non-

ferrous and high temperature alloys.

- Heat highly concentrated within the area of the weld minimizes distortion.
- Makes all type joints in all positions on metals .020 in, and thicker.
- Portable manual equipment, and semi-automatic and automatic units for all job needs . . . Semi-automatic hand-guided Heliarc welding attains speeds up to 50-in. per minute.

Start saving now—call your local LINDE representative for more information and ask for Form 7942, "Modern Methods of Joining Metals."

Linde Air Products Company

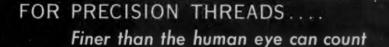
A Division of Union Carbide and Carbon Corporation

30 East 42nd Street III New York 17, N. Y.

Offices in Other Principal Cities In Canada: DOMINION OXYGEN COMPANY Division of Union Carbide Canada Limited, Toronto

> The terms "Linde" and "Heliarc" are registered trademarks of Union Carbide and Carbon Corporation.





(Illustrations enlarged 2½ times)

WITH THE DBS Style VERS-Q-TOOL, exacting instrument screw threads as fine as .045"-90 N.S. are cut consistently to Class 3 specifications, with a well-formed included angle.



This standard VERS-O-TOOL head cuts 'em by the thousands—exactly to specifications

Each threading job, whether it's tiny precision instrument parts, or huge oil field pipe lines, has its own special requirements. Maybe it's machinability, thread form or size . . . or it may be tolerances or fussy finishes.

In supplying and servicing National Acme Vers-o-tool heads for thousands of such threading jobs, our engineers have become familiar with all those requirements.

And it's a pretty good bet that in so doing, they have accumulated the experience which will give you the most accurate threads, with the least trouble—and at the lowest cost per piece.

You name the job. Vers-o-tool has the cost-cutting answer.

SEND FOR BULLETIN DT-52. Or, better yet, ask for our recommendations.

IF YOU CUT THREADS, TURN, OR FORM FROM THE END — Namco VERS-O-TOOL System gives you greater cost-reducing flexibility.

It's this simple -

- Take a standard Vers-o-tool (the self-opening die head—you don't have to back it off the threads).
- For threading, use National Acme ground thread chasers (for greatest economy use the circular type for long runs; the adjustable blade type for short runs).
- Convert to any other end turning or forming operation by changing only the cutters and blocks.
- Use Namco micrometer gage to check and set chasers or cutters during resharpening. No time-wasting trial cuts required.
- Standard Vers-o-tools are made in revolving Style DR and non-revolving Style DS for diameters .056" to 6½"; Style DBS for BSA and Brown & Sharpe automatics.









OUR JOB: to provide the Right Machine for YOUR JOB





Acmo-Gridley 4, 6 and 8 Spindle Automails Ber and Clushing Machines - Fully Automatic Turrer Lothes (Ber and Chuck Type) e Hydraulis Thread Rolling Machines • Automatic Threading Toels • Switches • Solenoids • Contract Manufacturing. THE NATIONAL ACME COMPANY

179 EAST 131st STREET . CLEVELAND 8, OHIO

Now you can make WELDED TUBES

faster, better, at lower cost, from-





Within the last few years rapid strides have been made by Yoder in widening the scope and raising the speed of cold process electric-weld pipe and tube making. In tube mills perfected by Yoder many non-ferrous metals can be induction-welded in gauges up to .154" and at speeds approaching those attained in resistance welding steel tubes.

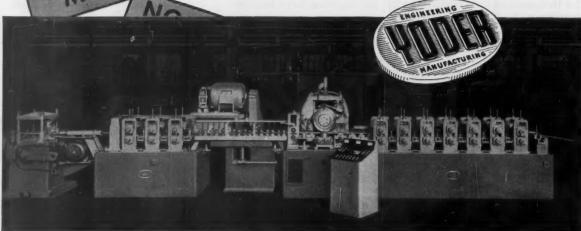
Further, speeds up to 250 fpm are reached in induction-welding steel tubing in the same gauges.

New, compact Yoder "4-in-1" Welding Transformer is the last word in resistance-welding steel pipe and tubing in sizes up to 24" diameter.

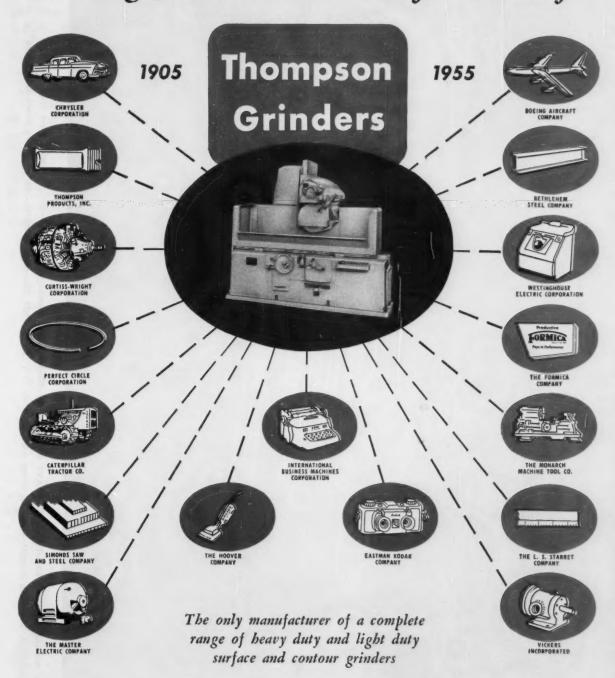
More specific information, literature and estimates on request, without obligation on your part.

THE YODER COMPANY

5504 Walworth Ave. • Cleveland 2, Ohio



Quality Speaks among the thousands of users of



THE THOMPSON GRINDER COMPANY, SPRINGFIELD, OHIO

THIS NEW MONARCE HEAVY



The MONARCH SERIES 90 DYNA-SHIFT HEAVY DUTY LATHE—Model 2500: Clearance diameter—40"... Swing over cross slide 25". Model 2501: Clearance diameter—44"... Swing over cross slide 31". Model 2502: Clearance diameter—48"... Swing over cross slide 36".

DUTY DYNA-SHIFT

Has a Headstock that Thinks!

Set the Work Diameter Indicator—Get Ideal Spindle R.P.M. in a wink—36 speeds from 6 to 750 R.P.M.

Think you've seen everything in lathes? Take a look! The new Monarch Series 90 Dyna-Shift marks a revolution in lathe design!

Its heart and soul is the exclusive Monarch Dyna-Shift drive headstock. With it any speed change may be made in seconds with it never being necessary for the operator to calculate the spindle speed (R.P.M.) from the work diameter and the desired surface speed (S.F.P.M.). He merely sets the work diameter indicator to the diameter to be turned. In a wink he gets the correct speed automatically, accurately, positively, and this speed is indicated for reference. What's more, with motor capacity equivalent to 60 H.P., this machine has the power to break and the speed to burn any carbide tool. Here's the ultimate proficiency in the use of carbide tooling—and on work of considerable size.

Imagine a machine with all the following advantages. Imagine it in terms of lowered costs! The Series 90 Dyna-Shift:

- Permits heavy depths of cut to be taken at more than average surface speeds.
- 2. Allows carbide tooling to be used to its fullest advantage.
- 3. Shears metal off cleanly at its proper cutting speed and feed.
- 4. Because it may always be used at its proper cutting speed and feed, it allows the ideal cutting condition of maximum tool life, heavy stock removal and close accuracy.
- 5. Combines convenience of operation with safety factors which adds to the machine's productiveness and the operator's enthusiasm for the piece of equipment on which he makes his living.

You'll want the full story of this great new lathe—for new it is from end to end! The Dyna-Shift and the many other features are revealed in detail in a complete 24-page illustrated booklet. Fill out the coupon today and let us send it. It's worth getting!—The Monarch Machine Tool Company, Sidney, Ohio.



When progressing from diameter to diameter, speed is changed in a few seconds with the flick of one dial. The machine celculates each speed and changes speed automatically. And the wide available range assures selection of the right speed for dimeter to be turned.



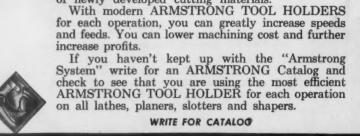


1601 with	ft story. P	lease send n data.	ne
	complete	Cata.	
ues engine	er call on i	116.	
Age of the second		TITLE	<u></u>
German .			-
			TIYSE

New ARMSTRONG Are you keeping up with the

Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLD-FPS constantly being developed to more effectively. ERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.



ARMSTRONG Carbide Tool Holders Carbide-Tipped ARMSTRONG "C-A" Tool Holders for ARMALOY Cast-Alloy

TOOL HOLDERS

ARMSTRONG Spring Form Threading Tool Holder

ARMSTRONG



ARMSTRONG BROS. TOOL CO.

"The Tool Holder People" 5213. W. ARMSTRONG AVENUE CHICAGO 30, ILL.



with TOCCO* Induction Heating

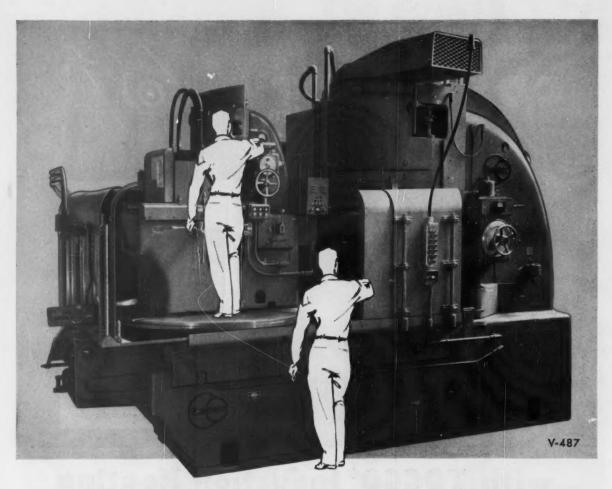
A cost reduction of 94% resulted when heat-treatment of this Corn Harvester part was changed from carburizing to TOCCO-hardening. Look at the unit cost breakdown:

CARB	U	R	12	21	N	G				TOCCO-Hardening
Degrease				٠		\$0.0020				eliminated
Carburize						0.0200				eliminated
1st quench						0.0150				TOCCO, heat and quench \$0.0060
2nd quench						0.0150				eliminated
Draw						0.0050				eliminated (self-draw)
Shotblast						0.0035	0	0		eliminated
Internal Grind						0.0243				eliminated
External Grind		0				0.0166			0	eliminated
						\$0.1014				\$0.0060

"-Savings of 9½ cents per piece—\$4770.00 on each 50,000 piece batch, plus an hourly production increase from 120 to 300 pieces per hour, plus improved quality of the product by virtue of the deeper case and stronger core."

Have you investigated TOCCO's cost-savings possibilities for your hardening, brazing, melting or forging operations? Why not write us today or send blueprints of your parts—no obligation, of course.

THE OHIO CRANKSHAFT COMPANY	NEW FREE THE OHIO CRANKSHAFT CO. BULLETIN Dept. M-3, Cleveland 1, Ohio
	Please send copy of "TOCCO Induction Heating."
	Name
	Position
	Company
CAN A CANADA	Address
JUST PU	CityZoneState



WE PUT ONE BLANCHARD ON ANOTHER ... to show you the wide range of sizes!

It's true! There's no "trick" photography involved. Our 5,400-lb. No. 11 Blanchard Surface Grinder fits snugly on the 84" chuck of our giant 61,000-lb. No. 42-84.

And, like all Blanchards, both have chucks flat within .0002"—guaranteed!

Do every surface grinding job in your shop perfectly . . . whether you grind tiny watch parts – steel plates 7 feet across corners – or anything in between . . . put it on a Blanchard.

Whatever your requirements for stock removal, tolerances or surface finish, ask for details on the 15 standard Blanchard models today.

One of them will fill your needs perfectly and will do your work with speed and precision — at costs which help you set competitive prices.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and

PUT IT ON THE (
THE BLANCHARD MACHINE COMPANY

PUT IT ON THE BLANCHARD

Surface Grinding".

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

"The Art of Blanchard

44-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257



DOUBLE BREAK, SILVER ALLOY CONTACTS

The silver alloy used for Allen-Bradley double break contacts remains always in perfect working condition. Hence, there is no need for contact maintenance. You can install an A-B starter and forget it.

ENCLOSURES for Every Operating Condition



NEMA type enclosures are available for Bulletin 609 and Bulletin 709 starters to satisfy any operating requirement.

The MOST POPULAR MOTOR STARTERS Trouble Free . . . No Contact Maintenance

These two Allen-Bradley across-theline motor starters . . . Bulletin 609 manual and Bulletin 709 magnetic . . . enjoy world-wide popularity because no matter what the service may be, they will not fail.

Both starters are simple, assuring long, trouble-free life. Both provide dependable overload protection to the motor. Both are pushbutton operated . . . one, mechanically through a snap-action linkage,

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.

and the other, electrically with a solenoid plunger.

For continuous plant operation, specify either Bulletin 609 manual or Bulletin 709 solenoid starters. For maximum protection to man, motor, and machine, the Bulletin 709 is best. Its "no-voltage" protective feature prevents accidental restarting of motors after power interruptions. Write for the A-B Handy Catalog—6th Edition.

In Canada—
Allen-Bradley Canada Ltd., Galt, Ont.











With standard lever & pilot light.



3-Way selector & pilot light.



With removable key switch.



NEMA Type 7 enclosure for hazardous dust or gas conditions.



NEMA Type 4 enclosure for watertight & weatherproof service.

BULLETIN 600 MANUAL STARTER

for Motors of 1 Hp or less

This compact toggle switch with a builtin overload breaker satisfies the National Electrical Code (Para. 4322 sub. C) covering overload protection requirements for motors of 1 hp or less.

QUICK MAKE & BREAK CONTACTS— The simple, rugged, over-center mechanism has a quick make and break action. No "teasing" of contacts means long contact life.

GENEROUS WIRING SPACE—Cover slips off, exposing front and both sides.
ATTRACTIVE APPEARANCE—The clean, modern lines are a sales asset to any machine. Enclosures listed for every service.

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis.
In Canada—
Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY
TROUBLE FREE MOTOR CONTROL

∂QUALITY



Flush mounting of two Bulletin 600 starters, each with a pilot light.



in a standard switch box.



In a surface mounted box.

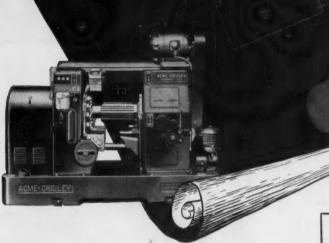


NEMA Type 4 enclosure with pilot light for use in wet locations.

HOW TO COMPLETE THE JOB Faster ...

AND STILL GET

MORE ACCURATE PARTS!



When you tool up jobs this way on an ACME-GRIDLEY MULTIPLE SPINDLE CHUCKING AUTOMATIC, you often *complete* the parts in one setup—and they are more accurate and uniform because rehandling and rechucking for second operation work is eliminated.

And the corollary to this is that man hours are released for other work—and space formerly needed for second operation work is saved.

On this cast iron housing, all 17 operations were performed simultaneously, with a *single completely carbide-tooled setup*—on an Acme-Gridley 8-inch, 8-spindle chucker. And because the work on all spindles is always done within the time required for the longest single cut, the floor-to-floor time on this job was at the rate of 61 *completed* pieces per hour.

This is where multiple spindle planning pays off.

JOB FACTS

- Roughing and finishing operations performed on this SAE 120-121 Cast Iron Housing include multiple recessing shown in sketch. The three grooves were rough recessed in one station and finished recessed together with front and rear counterbore in another position.
- Other rough boring passes were finish-reamed with accelerated reaming attachment in one pass.
- Carbide tooling used throughout.

And this is where the vast experience of National Acme tooling engineers (they have helped plan the cost-reduction of more than 300,000 jobs) wins and holds preference for Acme-Gridley bar and chucking automatics—in hundreds of shops.

These engineers will give you sound advice; unbiased advice in both job setup and equipment—from the world's only manufacturer of a *complete line* of multiple spindle bar and chucking automatics and fully automatic turret lathes.

Send for Catalog CM-51 or ask for our recommendations



THE NATIONAL ACME COMPANY

179 EAST 131st STREET . CLEVELAND 8, OHIO

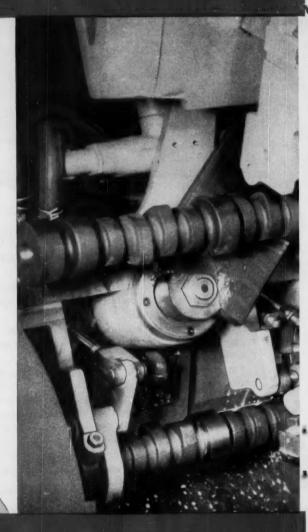
Automation YESTERDAY > TODAY > TOMORROW >

We have been building automatic work handling and work transfer systems for over a quarter century. Lo-swing Automation Methods provide a means for production manufacturers to extend the automaticity of individual machines through a series of successive, though dissimilar, operations to combine work loading, machining, gaging, work transfer, and inspection into one single, automatically-controlled phase of the production flow. Let Seneca Falls engineers help solve your automation problems.

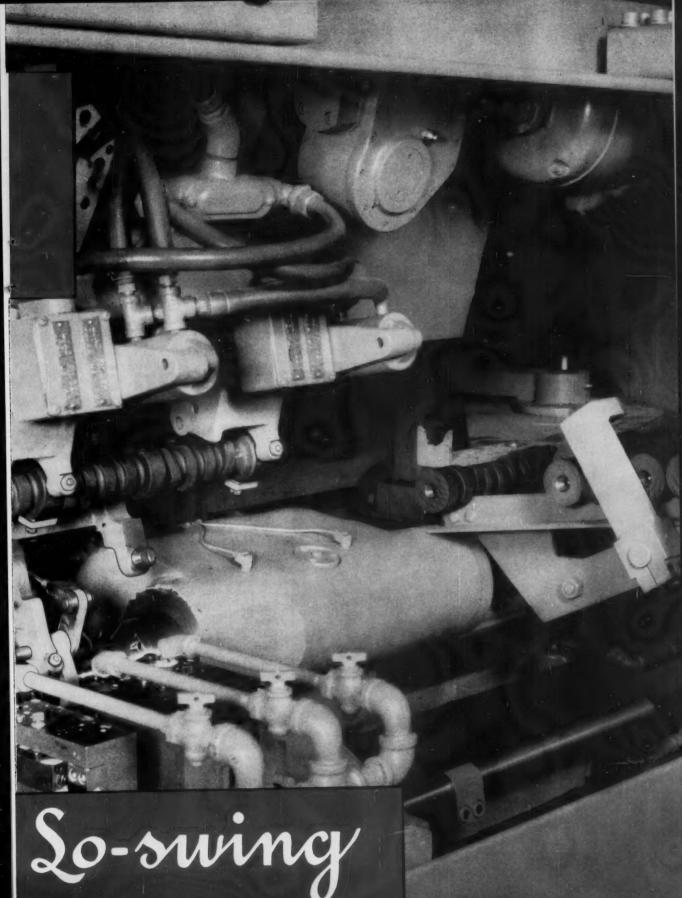
SENECA FALLS MACHINE CO. SENECA FALLS, N. Y.

> The loader illustrated will handle any work that can be held between centers. Other loaders are designed for chuck work.

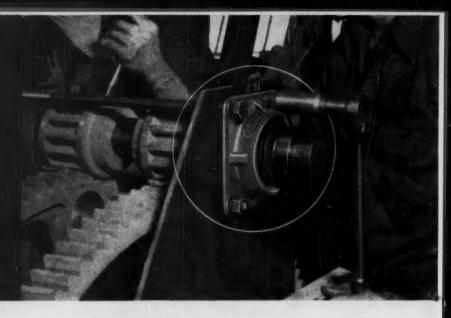
TODAY ... ANY COST THAT CAN BE"CUT" IS TOO HIGH!



LOWER YOUR COSTS WITH



If assembly costs are lower



chances are

Fafnir has a bearing on it



The installation of a Fafnir Ball Bearing Flange Cartridge on the pinion shaft illustrated is being made with a socket wrench. No complicated blue prints, no costly machining, no time-consuming fitting and adjusting of bearing. Assembly costs have been cut without cutting corners.

The use of a completely-housed ball bearing unit is only part of this cost-cutting operation. The Fafnir Unit offers additional cost savings. Its bearing inner ring is bored for a slip fit. The eccentric cam design of its inner ring and collar makes locking action positive with a twist of the wrist. No lock nuts or adapters are needed. No adjustments of any kind are necessary. The bearing can't be cramped or overloaded when mounting.

If you are looking for a way to cut assembly costs, maybe Fafnir can help you through better, more economical use of bearings. The Fafnir Bearing Company, New Britain, Conn.

MOST COMPLETE LINE IN AMERICA



FAFNIR BALL BEARINGS

Pressroom saves \$16,982 in oiling labor in 4 years

with Farval lubrication

FARVAL— Studies in Centralized Lubrication No. 159

HOW fast and how dependably could men with grease guns and oil cans lubricate 1294 bearings on 36 presses? The answer is—not fast enough—15 to 20 minutes per press, with the press shut down. And not too dependably, for bearing failures and consequent expensive shutdowns result when bearings are skipped in the lubrication cycle.

These shortcomings of hand lubrication led an Indiana metalworking plant to install Farval Centralized Systems of Lubrication four years ago.

Farval is economical

For a modest average cost of \$295 for smaller presses to \$1,164 for larger, Farval was installed to protect expensive bearings and to maintain production schedules. The four-year record shows Farval has already saved this company \$16,982 in man hours alone. Farval has also saved uncounted thousands of dollars in production time and thousands more in bearing repairs and lubricant cost.

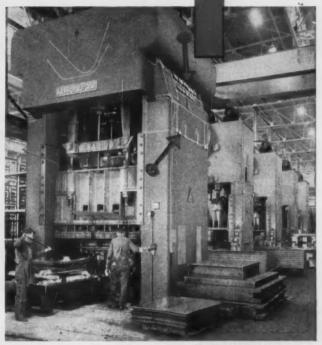
How Farval works

Farval is the original Dualine system of centralized lubrication that hydraulically delivers oil or grease exactly measured, to each individual bearing as often as desired. The Farval valve is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Indicators at every bearing show that each valve has functioned. To lubricate an average press with Farval takes only one minute while the press is in operation!

Why don't you ask your Farval representative about our Free Plant Lubrication Survey? Or write for new Bulletin 26. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.







KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farvai—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

Top and bottom: These presses in a large metalworking plant are lubricated by Farval automatic systems for which pumping stations are set up directly below them in the basement. Photos courtesy of Budd Company.

AN AMOUNT.LOW COST

ACME THREADING MACHINE

Model XLA

A basic, low cost, heavy duty threading machine specifically designed for precision threading on the larger sizes of maintenance work. The ACME Model XLA can be easily equipped with those automatic features required to meet your individual needs for quantity production operations. The 60 year tradition of ACME precision and versatility has been maintained.

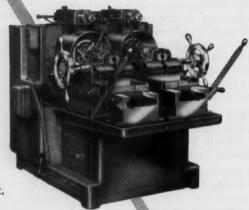
The new ACME Model LLH die head (standard on all ACME Model XLA Threading Machines) will accommodate either radial or tangential chasers.

Manufactured in single and double spindle design in 1", 1½", 2" and 2½" capacity sizes.

Here is your opportunity to get a precision threading machine with the versatility of more costly equipment at a price within your budget.



SEND FOR BULLETIN 2-XLA



THE HILL ACME COMPANY

ACME MACHINERY DIVISION . 1209 W. 65th St., Cleveland 2, Ohio

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR GRANES • "CLEVELAND" KNIVES • SHEAR BLADES



carbide service available

data for comparison

Part Machine **Petcock Center** 15%" Six Conomatic 100% Carbide Tipped

Tools Material Stock Size

X-1112 1" Hexagon

R.P.M.

1562

Time

8 seconds

Where conditions are favorable, 100% carbide tool-ups on "Automatics" make HSS tools appear as obsolete as ancient tools of carbon steel.

In determining the "favorable" conditions, the Conomatic Carbide Development is of real service to the "Automatic" user. Without risk of production loss or obligation of machine purchase, he gets an eye-witness demonstration of the profit possibilities of 100% carbide tooling to his own work.



Conomatic } Cone AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-51

FOOTBURT

for faster radial drilling and tapping



Hammond Radial Drilling and Tapping
Machines may be spotted in the production
line for drilling, tapping or reaming. With
its unique Bracket Type construction the spindle
can be swung quickly from hole to hole. Six
Quick Speed Changes are instantly available
and the Hammond Tapping Reverse
is very fast and convenient to operate.

THE FOOTE-BURT COMPANY

Cleveland 8, Ohio

Detroit Office: General Motors Building





Hand Finished!

Yes, even in 1955 there are certain jobs that only skilled hands and sensitive human perceptions can do best. Precision thread lapping after grinding is one such job.

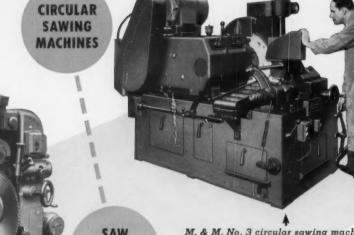
Back and forth, back and forth, removing microscopic amounts of metal until the "feel" is right. Then an instrument check, and back to the lap. And so on and on until perfection is attained.

An expensive operation? Yes. But that's why precision lapped gages outwear ground only gages wherever they are used. When you buy thread gages, always ask, "Are they precision lapped?"

GREENFIELD TAP and DIE CORPORATION

HIGH CUTTING COSTS

CIRCULAR SAWING MACHINES



BLADE SHARPENERS M. & M. No. 3 circular sawing machine for cutting off metal up to 11-5/8" diameter.

Three automatic M. & M. blade sharpeners impart the Triple-Chip or conventional grind to M. & M. saw blades up to 120" diameter.



M. & M. saw blades cut any machinable metal. Cut-off blades: segmental — 11" through 120" diameter; solid — 8" through 20" diameter. Slitting saws — 3" through 8" diameter.

You may profit immensely by applying the M. & M. Triple Threat to your cut-off costs. Machine, blade, and grinder, made by the first company to build all 3, often effect phenomenal savings, as proved by detailed case studies. Just such a study of your job is yours for the asking. We offer you an unmatched experience in the sawing of metal, ferrous or non-ferrous, titanium to magnesium, from 1/4" to 43" diameter.

MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

for a real COOL cut . . .



get the COOLING ACTION of a mountain stream and faster, cleaner cutting, too!

ANTISEP All-purpose Base gives you everything you want for tough machining jobs. It has extra lubricity to insure fast, free-cutting on tough metals, helps impart a finish to make any machinist proud. It is anti-welding, helps prevent chip build-up on tools. But all of this is only part of the real value of ANTISEP.

Because this super base is mixed with water, it assures cool operation at maximum feeds and

speeds and at low cost. You can step up production measurably, and still have a smoke-free plant and finer finished work.

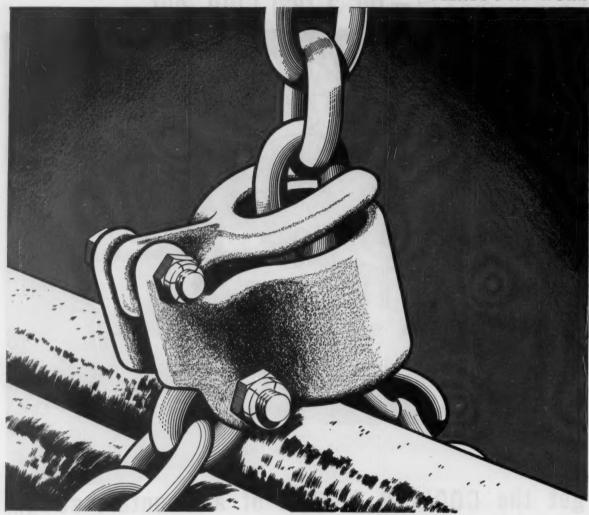
Put ANTISEP to the test on the toughest jobs in your plant and see the evidence with your own eyes. Call your Houghton Man today or write direct to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

All-purpose water-soluble base

, a product of

Ready to give you

on-the-job service . . .



MORE AND MORE FLEXLOC LOCKNUTS are being used on applications where dependable locking is essential to the operation of the equipment and the safety of the operator. This bundling chain with automatic lock provides positive grip and safe, sure bundle handling.

Two FLEXLOC Self-Locking Nuts hold this assembly together. Once the locking threads are fully engaged, the nuts won't work loose, regardless of the conditions under which they are used.

FLEXLOC one-piece, all-metal nuts are available in a full range of sizes in any quantity. Standard FLEXLOCS are stocked by leading industrial distributors everywhere. Write for Bulletin 866 and samples. STANDARD PRESSED STEEL Co., Jenkintown 19, Pa.

DO YOU KNOW? Standard FLEXLOCS smooth off rough bolt threads. The locking threads on all-metal FLEXLOCS are not chewed up when used on rough bolts.

Standard FLEXLOCS lock securely on bolts varying in diameter tolerances. The all-metal, resilient locking sections of the nut accommodate themselves to the diameter tolerances.

Standard FLEXLOCS are one piece, all metal. They are not affected by temperatures to 550°F. Nuts lacking these features have a more restricted temperature range.

Standard FLEXLOCS lock securely—stopped or seated—when 1½ threads of a standard bolt are past the top of the nut.

Standard FLEXLOCS are not affected by moisture, oil, dirt or grit. They lock efficiently under all conditions, regardless of the vibration encountered.







BIG CARBIDE PLANING PROFITS



The F. X. Hooper Co., of Glen Arm, Md. is successfully and profitably carbide planing cast Iron frames on this new 84" x 60" x 18' high speed GRAY PLANER.

GRAY CARBIDE PLANER

- using modern carbide tools at speeds up to 300' per min. — feeds up to 1/8" and depths of cut to 11/4".
- Check your planer department's time and cost figures. New GRAY performance will make your old planer really old.

The G.A. GRAY Company

CINCINNATI 7. ONIO. U. S. A.

SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. . SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-57



BRISTOL CONN. LUDIOW 2-

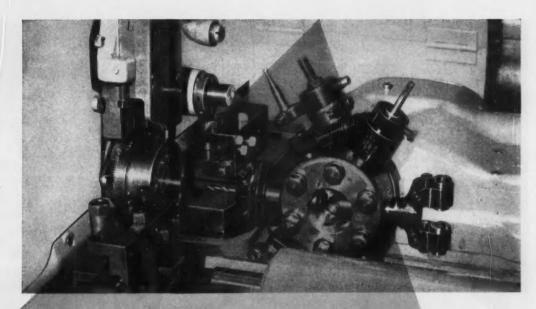
Feed-back principles are employed in this ball race form grinder at New Departure. The machine automatically adjusts to maintain specified tolerances. More perfect pieces per hour mean lower costs for the bearing user.

Quality control is of prime importance in the high-volume, ultra-precision manufacture of ball bearings. Balls are auto-matically inspected by an electronic scanning device that operates with a speed and accuracy considered to be impossible a few years ago.

PLUS ENGINEERING SERVICE

New Departure engineers are ready to help with your ball bearing problems. And when you consult with New Departure you get the benefit of more than 50 years' experience in ball bearing design and manufacture. Call, wire or write . . . New Departure can help you . . . PDQ! NEW DEPARTURE . DIVISION OF GENERAL MOTORS . BRISTOL, CONN.



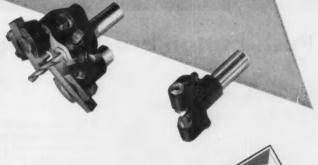


A MACHINE IS ONLY AS GOOD AS THE TOOLS USED ON IT!

FOR PRECISION AND
ECONOMY — R and L
TOOLS ARE UNBEATABLE

That is why leading manufacturers* supply R and L TOOLS as original equipment with their machines. We know of no finer testimonial, with the possible exception of the fact that last year 86.7 of all R and L TOOL orders were repeat orders . . . Satisfied customers who wanted more of the precision, time-saving and moneymaking qualities built into every R and L TOOL.

*List of manufacturers supplied on request.



Write for new catalog

CLIP AND MAIL THIS COUPON

K and L TOOLS

- Please send me your new catalog
- Please arrange for no-obligation demonstration of R and L TOOLS

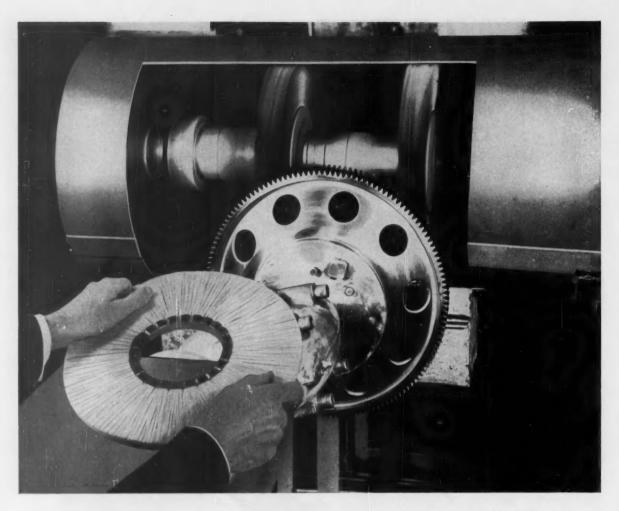
COMPANY

ADDRESS

TOOLS

1825 BRISTOL STREET - PHILADELPHIA 40, PA

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES)
• UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL



Push-button brushing beats handwork 15 to 2



PRODUCTION EFFICIENCY IS HIGHER. Now it's easier to produce uniform finishes on many types of gears. Setup is simple ... operations are done on preset time cycles to cut manufacturing costs.

What manual operations could an OBA eliminate for you?

7½ times us fust. Here, Osborn Fascut® Brushes are removing burrs and blending surface junctures on spur gears. Each gear has two internal and two external gear sides that must be finished. Rate . . . 15 gears or 60 gear sides per hour. Former rate with manual method was at best two gears an hour.

Scrap has been virtually eliminated by Osborn's Power Brushing method. That's because surface quality of gears is more uniform. Stress concentrations have been eliminated by the surface juncture blending of gear teeth.

An Osborn Brushing Analysis can show you how to improve your operations through power brushing and benefit with savings like these on your cleaning, finishing and burr removal jobs. Call or write The Osborn Manufacturing Company, Dept. D-27, 5401 Hamilton Ave., Cleveland 14, Ohio.



BRU BRU

BRUSHING METHODS . POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES . FOUNDRY MOLDING MACHINES

OSBORN

60-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257

This "editorialized message" was written after learning the results of an extensive survey recently made by another organization.

LAPOINTE the name that is KNOWN in BROACHING

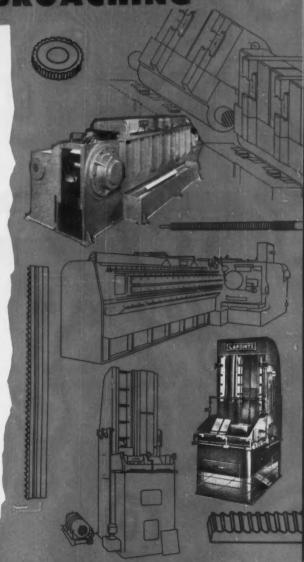
In any industry, there's always one manufacturer's name that stands out — that comes to mind first when you think about that industry. You know this is true. You can think of several, right now, without half trying.

In the field of broaching, men for a great many years have put Lapointe at the top of the list in this matter of name recognition. That may be caused partly by Lapointe's age, for Lapointe did indeed pioneer the development of broaching 53 years ago. Or it may be caused partly by Lapointe's size, for Lapointe several times has been forced to substantially increase its plant, this physical growth placing Lapointe always in the "number one" spot as the world's largest manufacturer of broaching machines and broaches.

But age and size alone do not necessarily constitute leadership, or assure that yours will be the name that is known. Here at Lapointe we like to think that it comes from the capable, loyal organization that has been built up through these many years of making broaching equipment exclusively. Our engineers and our plant personnel live in the atmosphere of broaching. And this activity embraces the entire broaching process—including not only the machines and tools but also the designing and building of the all-important fixtures that so often make the difference between success or failure in a particular broaching application.

It is this engineering experience, this ingrained and intuitive "broaching sensitivity", that keeps Lapointe at the top of the list.

We realize that no amount of advertising could accomplish that result. No, it's the quiet recognition and acceptance by important men in industry who know broaching, that makes Lapointe "the name that is known." We are grateful for this, and we intend to keep it that way.



THE

LAPOINTE

MACHINE TOOL COMPANY



THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

RUGGED PRESSES

DESIGNED BY BLISS

FOR THE AGE OF AUTOMATION

Bliss 'packaged presses,' built to JC standards, offer advantage like these

- All piping and wring for press controls, automatic work-handling devices and maintenance tool power outlets are built into the uprights.
- Cuts installation time and cost—practically of the installation crew has to do with the press "plug it in".
- Eliminates split responsibility or press perform ance—centers it instead on the press builder.
- Simplifies installation and maintenance of dopers cushions lifters, Iron Hands and other work handling devices.
- Leaves clean, uncluttered exterior—cranes can move up close to load or unload dies withou bumping or snagging.

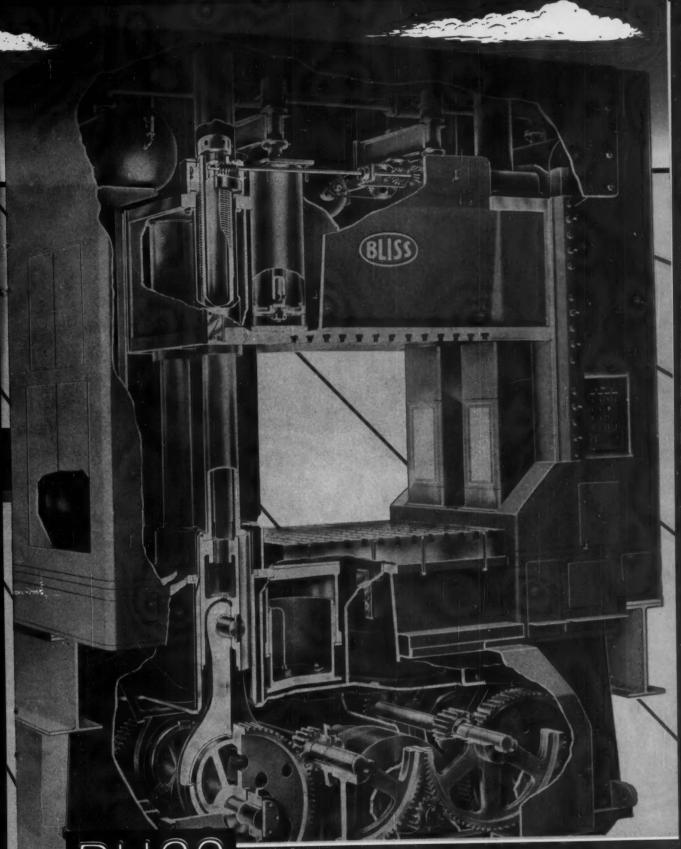
FOR MORE INFORMATION, WRITE

E. W. BLISS COMPANY, Canton, Ohio Presses, Rolling Mills, Special Machinery

J. S. Plants in Canton, Salem and Toleto, Ohio; Hastings, Michigan; Sar Jose, Calif. Other representatives in principal cities throughout the world

Seneath the sleek exteriors are these new design features—

- Heavy frame construction For a century, Biles has been known for its emphasis on heavy frames. With big presses like these, Bliss' heavy sections and internal ribbing easily take quick shock loads in stride.
- Extra-long gibbing—slide works entirely within gibs, even when adjustment is down. Motorized slide adjustment is self-braking, assures accurate positioning. Slide runs true at all times, meaning longer die life and greater accuracy.
- Integral gear and eccentric drive—its compactness allows gears to operate within the crown. No overhanging gear guards. And Bliss' design eliminates torsional deflection of main pin, minimizes distortions due to overloads.
- New automatic lubricating system—a recirculating type which has proved foolproof in service. Positive piston displacement method automatically lubricates every bearing surface at predetermined intervals. Electrical interlocks shut down press if a single feeder fails.
- Cool-running high speed clutch Bliss' combination pneumatic friction clutch and brake is extremely fast only a fraction of an inch needed between full engagement and brake. Self-aligning feature automatically compensates for wear. Clutch is also self-cooling.

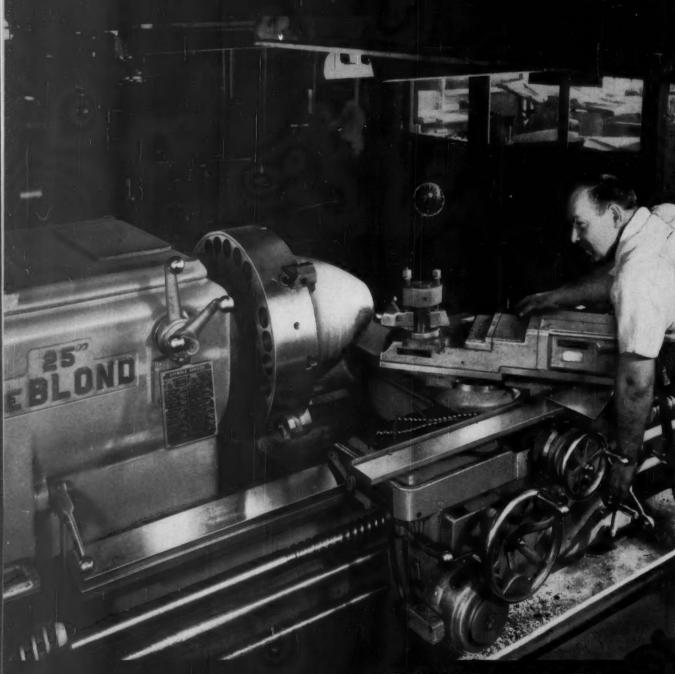


BUSS is more than a name...it's a guarantee

SINCE 1857

At United Specialties Co....

Here's Diversified Toolroom Turning-



Turning Spin Blocks (dies) for TV Cones— United uses 24" tool steel blocks to spin their metal TV cones. Large swing capacity in their LeBlond Toolroom lathe allows them to handle these die-turning jobs promptly as they are needed. They get high speed, excellent finish and accurate contours.

from 1000 lb. Spin Blocks to Contoured Stamping Dies

Accomplished with smooth-powered LeBlond 25" Tracing Lathe

Toolroom jobs at United Specialties Co., Chicago, required a big-swing lathe for pieces like heavy spin-blocks, plus convenience and ease of handling on smaller die jobs—many with difficult contours.

Sales engineers at our Chicago Office recommended a LeBlond 25" Heavy-Duty Lathe with Hydra-Trace. It gave United just what they needed—bigswing, smooth power, a lathe that could tackle virtually any of their die-turning jobs.

Mr. M. J. Perkovich, Toolroom Superintendent for United Specialties, says "Our LeBlond Lathe with Hydra-Trace works at least 75% to 175% faster than previous methods. And it completely removes all 'guesswork' on the part of our operators when shapes and radii are involved."

In the toolroom or on the production line, you can count on LeBlond Heavy-Duties with Hydra-Trace to have plenty of "beef" for heavy hogging, plenty of accuracy for extra-fine finish. And they're ideal for complex contour and angle work. Hydra-Trace attachment is easily and quickly installed or removed. Gives maximum flexibility of adjustment for best working angle.

LeBlond Heavy-Duty features include: 4-direction power rapid traverse built into apron; one-piece double-wall apron, hardened rack; totally-enclosed quick-change box; hardened and ground replaceable steel bed ways; thrust lock tailstock. See your LeBlond Distributor today or write for bulletin HD 155T-D.

Turning mating dies for stamped air-cleaner parts—United stamps out complicated ridged and contoured air-cleaner parts, in many sizes and shapes. In each case, mating "re-draw and size" dies are needed. Die shown above, for instance, has 11" O. D. with complex contours and angles, calling for tool "dive-in" on some surfaces. As a result, top cutting speeds cannot be used. United happily found that their LeBlond 25" gives them all the power they need, even at low rpm—with no stalling, no shakes and jitters, no ruined dies or frayed tempers.

Hydra-Trace (Trade Mark, Registered U. S. Pat. Office) is LeBlond's heavy-duty hydraulic tracing attachment. Can be mounted in place of the compound rest on practically all LeBlond Lathes.

.... cut with confidence

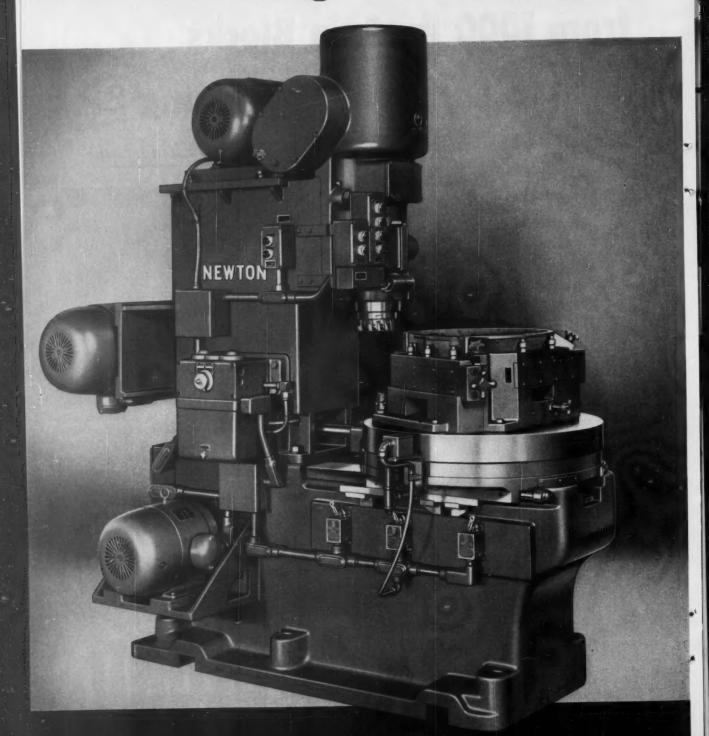


THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES . FOR MORE THAN 67 YEARS.

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-65

For Milling the flanges

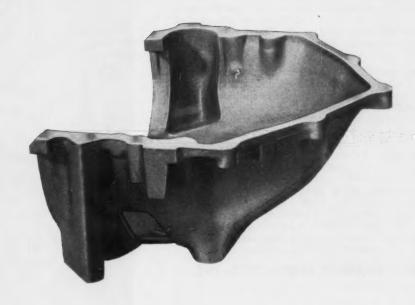


CONSOLIDATED MACHINE TOOL

A Division of Farrel-

of thin Castings...

Newton Vertical Rotaries



- You can't mill the flange on this flywheel housing like you would a cylinder block. It's too thin for big diameter cutters.
- But you can mill it with a small diameter cutter on a Newton Vertical Rotary and mill it fast! All the operator does is load, push a button and unload. A 100 per cent automatic feed and traverse cycle does the rest.
- Of course, it is the *circular feeding of the table* that turns the trick and allows you to use small diameter cutters on this kind of work.

COMPANY, ROCHESTER 10, N.Y.

Birmingham Company, Incorporated

wanted:

lower

The installation of a new Danly Press in any press line can produce exceptional cost-cutting results. This fact has been proved in the production records of leading stamping shops throughout the country. But when you count pieces at the end of a shift, it's the efficiency of the whole line that really counts. That's why production chiefs are specifying complete lines of new Danly Presses.

Running together as an integrated production unit, Danly Presses turn out more finished stampings per shift-at lower cost and with fewer line shutdowns. This is the kind of performance you can expect from Danly Presses. The reasons for it are many: Danly's heavier, more rugged construction gives the reserve strength necessary to meet the demands of continuous peak-load line operation. Automatic oil lubrication saves hundreds of hours of press maintenance. Exclusive electrical and pneumatic control devices permit convenient automation adaptability and increased safety. Danly's cooler running clutch and brake wear longer, need less replacement. From blanking to finished stamping, every Danly Press delivers more work per shift. Write to Danly today . . . experienced press engineers will be glad to discuss your specific stamping problems.

DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue, Chicago 50, Illinois



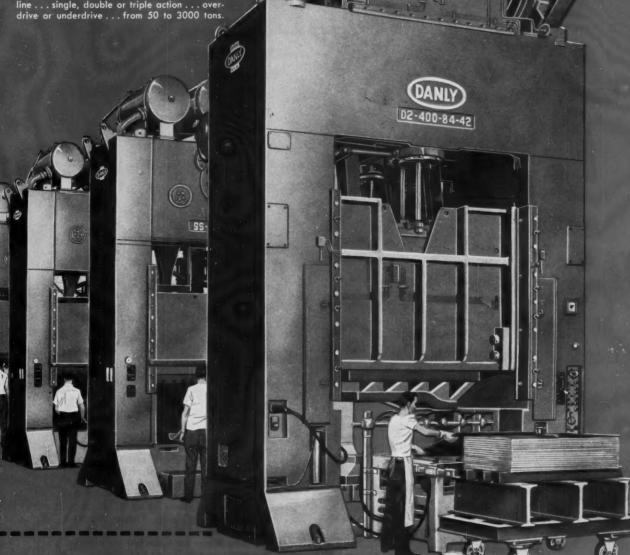
It costs less to run a DANLY PRESS line!

specify:

COMPLE

cost stamping output

Here is a line of Danly Presses in a leading stamping shop, working together as an integrated production unit. A line like this multiplies the production and cost advantages of each Danly Press...turns individual press efficiency into plant production efficiency and profit. Danly offers any presses you need to make up your line...single, double or triple action...overdrive or underdrive...from 50 to 3000 tons.



TE DANLY PRESS LINES

Save labor... cut costs with

FASTER Riveting and Clinching!



RIVITORS

T-J RIVITOR used for automotive clutch plate assembly. Saves time and labor doing a four-fold job-assembling, setting, inspecting and ejecting.

DOUBLE RIVITOR sets two rivets at a time! Equipped with 10" hoppers, and tooled to automatically feed and set two 1/4" dia. x 1/4" long wagon box head rivets at a time in elevator chain and raddle or elevator flight assem-blies for farm implements. Controlled by one foot pedal.



CLINCHORS

T-J CLINCHOR... one of six special 8" throat Underfeed Clinchors used by a large automotive body manufacturer. Feeds and sets 11/16" square cased nuts in outside quarter panels, left and right hand.

DOUBLE CLINCHOR sets two nuts at once! Tooled to feed and set %" x ½" x 1/16" thick Fabri-Steel nuts at each operation. Both Clinchors tripped by same foot-operated valve. Adaptable to wide range of clinch nut setting problems.



Automatic Feeding and Setting

T-J meets your needs for labor-saving SPEED in assembly . . . with performance-proved Rivitors and Clinchors for many jobs today...in aircraft, automotive, farm machin-

ery, stampings of all kinds.
T-J CLINCHORS set clinch nuts 3 to 5 times faster! Fully automatic . . . controlled by a single foot pedal! Available in Underfeed and Gravity feed models, throat depths 8" to 36"

T-J RIVITORS automatically feed and set solid rivets . . . with high production! Electrically powered Rivitor sets 1/16" to 4" diam. solid steel rivets up to %" long. Air-powered Rivitor sets aluminum alloy rivets up to ½" diam. or steel rivets up to ½" diam. and up to ¾" long. Throat depths 8" to 36".

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Co., Jackson,

37 YEARS EXPERIENCE (T-J)

TOMKINS-JOHNSON

18,000 CHIPS Per MINUTE!

18,000 CHIPS like these per minute . . . 6-pitch band tool at 250 FPMI

New Automatic Power Saw Cuts Cut-off Costs 50% and More!

You can drastically reduce cut-off costs through savings in time, labor and material with the new DoALL Power Saw. Using DoALL's new high-speed steel Demon Band Tool, this saw cuts faster than any other machine in the world of comparable price and capacity, including power hack saws.

DOALL
The Boall Company
Bos Plaines, Ill., U.S.A.

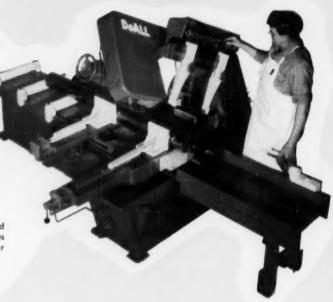
. . . turn the page for details.

NEW MACHINING TEAM

DoALL Power Saw . . . Outperforms All Others!

- ★CUTS FASTER—cuts 25% to more than 50% faster than power hack saws of comparable capacity and price... pays off fast in labor savings and higher output per machine.
- *SAVES MATERIAL—just compare the 1/16" kerf cut by the thin, continuous cutting DoALL band tool with the 1/16" kerf of hack saw blades or 1/4" cut of a cold saw . . . you save 1/2" or more of costly stock every 8 cuts!
 - ★LOW TOOL COST—the new DoALL Demon High-Speed Steel band tool lasts up to 10 times longer than previous carbon steel saw bands... you get tremendous output per dollar of tool cost!

★CAPACITY UP to 12" rounds, 12" x 12" flats.



You can put a terrific cutting load on a Demon Blade—a continuous band of high-speed steel. It retains its hardness up to 1100°F compared to only 350° for carbon steel blades. Available in Precision and Buttress type . . . in welded bands to fit the DoALL Power Saw . . 1" wide . . . 2 to 10 pitch depending on material to be sawed.

Demon Precision

NEW DOALL

You can put a terrific cutting load on a Demon Blade—a continuous band of high-speed steel. It retains its hardness up to 1100°F compared to only 350° for carbon steel blades. Available in Precision and Buttress to the DoALL Power Saw . . 1" wide . . . 2 to 10 pitch depending on material to be sawed.

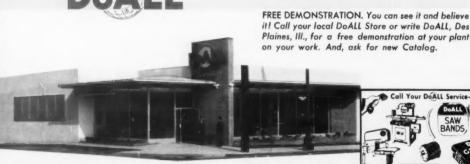
THE new DoALL Power Saw and DoALL Demon high-speed steel band tool is the most productive cut-off team ever developed. Continuous high-speed cutting . . . stock-saving narrow kerf . . . great accuracy . . . straight cuts . . . good finish . . . automatic operation . . . minimum floor space . . . hydraulic controls . . . easy operation . . . low maintenance—all these and more cost-reducing benefits accrue to its users.

FULL AUTOMATIC or MANUAL FEED—models available with fully automatic feeding, indexing and sawing for high volume production, or with manual feed when desired.

VARIABLE SPEED—90 to 350 FPM for greatest sawing versatility and efficiency. Step or single speed drives optional.

CONSTANT BAND TENSION AND FEED PRES-SURE, automatically maintained for optimum sawing efficiency.

To cut your cut-off costs, get the facts . . . then judge for yourself!



Friendly DoALL Stores...(in 40 cities)

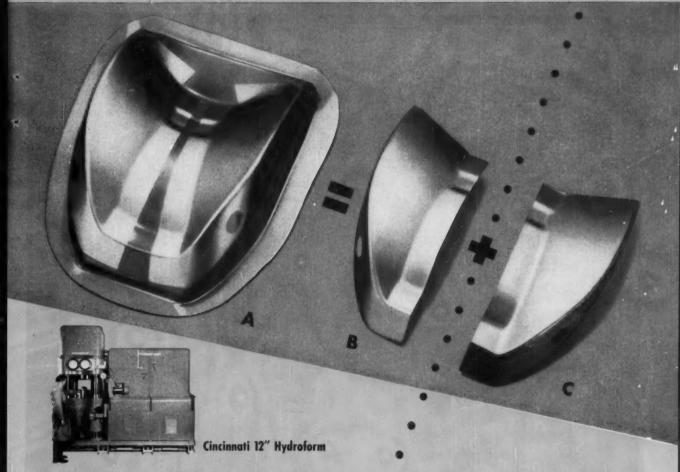
Personalized Service...Complete Stocks...Local Delivery



WALL CHARTS

\$1.00 each postpaid
Lower quantity prices.

Tricky automotive part gets the Hydroform treatment



With the help of the Cincinnati Hydroform, a supplier to the automobile industry has greatly simplified his production of complex-curved, right-hand and left-hand body structural components.

In the example illustrated above, shape "A" was accurately developed, then readily drawn on a 12" Hydroform from a 10¾" dia. blank of 20 gage cold rolled steel. (Note the extreme variations in contours.) Parts "B" and "C" were produced simply by sawing the parts out of the drawn shape. Shape "A" has been masked and paint sprayed, forming guide lines for sawing.

Tool costs were exceptionally low. The Hydroform punch was cast to shape in Kirksite. The draw ring was made from ordinary steel, with a band-sawed opening for the punch.

A similar Hydroforming procedure to that described above is being used successfully, with very substantial time and tool-cost savings, for the forming of duct sections for jet engines from heat-resisting materials

Have you fully investigated the many Hydroforming advantages . . . and if Hydroforming can be profitably applied to your work? Let a Cincinnati Milling field engineer give you complete information. For a description of the Hydroforming process and specifications of the 8", 12", 19", 23", 26" and 32" machine sizes, write for Bulletin M-1759-3.

Hydroform

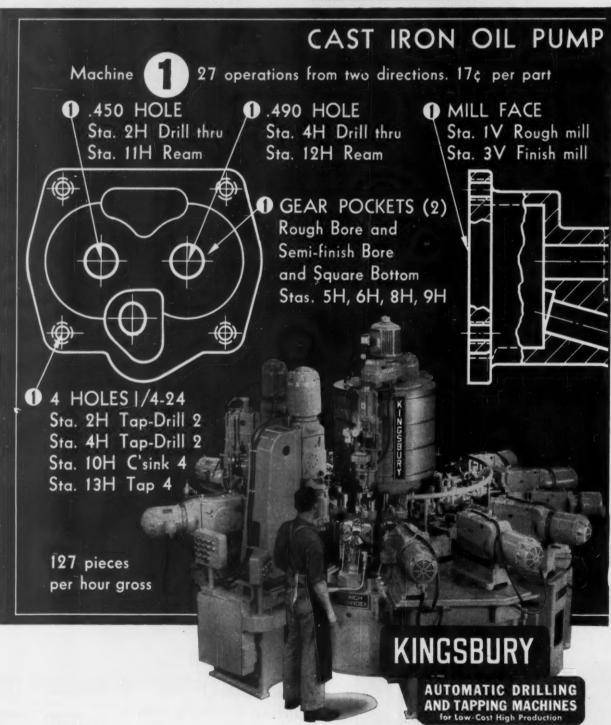
PROCESS MACHINERY DIVISION

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.



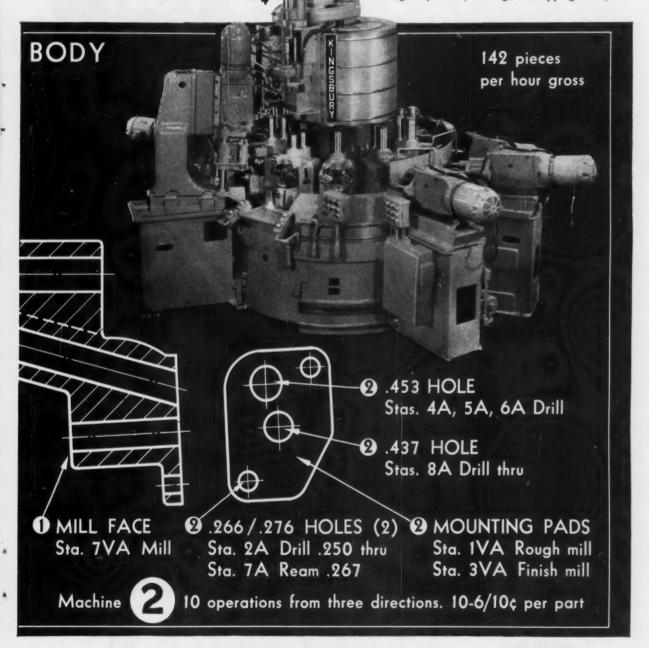
"Operations Kingsbury" These two machines, working as a team, perform an <u>average</u> of 3879 operations per hour, machining 102 <u>interchangeable</u> parts



The blueprint tells only part of this Kingsbury story. The rest is told in Keene, New Hampshire, in one of the most modern machine tool plants in New England. Here Kingsbury engineers study your part specifications — for your Kingsbury must do the operations you require at the rate you name. Each Kingsbury machine is custom-built,

but it is never built "from scratch." Even the work-holding fixtures, specially designed for each part, are developed from a background of years of experience and

knowledge of what is required for accuracy and safety — and what works. Every mechanism has been tested in field service. Standard Kingsbury bases, drilling, and tapping units,

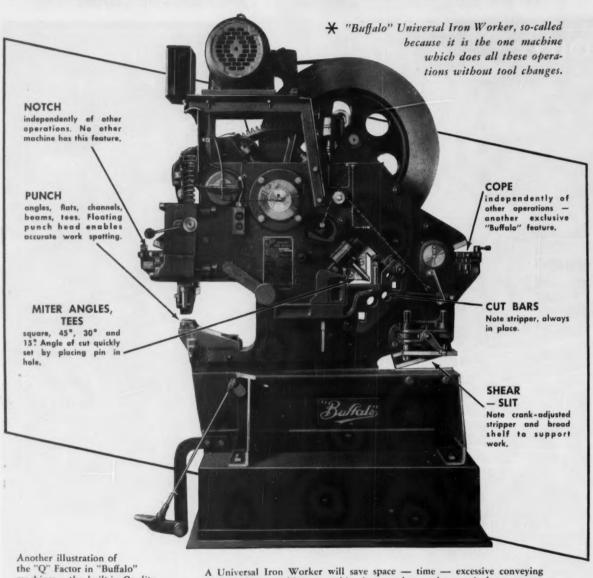


indexing mechanisms, lubricating and cutting-oil systems, electrical and mechanical controls . . . all are coordinated in an automatic machine which must perform correctly "first time round" — and year after year in your plant. Perhaps our mental attitude has a lot to do with the success of Kingsbury machines. We are

specialists. Since 1918 we have built more than 5,000 Kingsburys and we know what a Kingsbury can do. When we tell you a Kingsbury can do your job to your satisfaction, we're ready to prove it!

KINGSBURY MACHINE TOOL CORP. 108 Laurel Street, Keene, N. H

YOU CAN DO MORE JOBS IN LESS TIME — WITH A U.I.W.*



Another illustration of the "Q" Factor in "Buffalo" machines—the built-in Quality which provides trouble-free satisfaction and long life.

A Universal Iron Worker will save space — time — excessive conveying of work from machine to machine in your shop — because it does so many jobs. Often called the "most useful machine in the shop". For complete details, write for Bulletin 360.





BUFFALO FORGE COMPANY

440 BROADWAY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING .

PUNCHING

SHEARING

BENDING

NOT JUST BETTER-



but Much Better!

Test the Dimensionair by the most rigid methods and you will see beyond all doubt that it has unparalleled accuracy and that it has many advantages beyond your expectations.

Put it in your plant — alongside any other air gage — and still more advantages will become definitely obvious.

Just setting it ready to gage is strikingly simple and fast — less than ten seconds — absolutely no fiddling around balancing air pressures.

It is the only dimensional air gage made to a definite predetermined accuracy. All critical dimensions are made precisely to specified tolerances to assure that accuracy. Every gage repeats the same measurements. It is the only air gage accurate enough to have a calibrated scale when set to one master. Its calibration is not left to the operator's adjustments but is built into the gage.

If you use old style air gages and are unfamiliar with the Dimensionair, you'll really appreciate its accuracy and ease of handling. If you will give yourself a break and really investigate the Dimensionair — and try it — you'll say, too, "There's no comparison". You will really like it.

Its eleven advantages positively justify the time you take to find out that these claims are not exaggerated. In quick, simple set up, speed of setting, gaging accuracy, stability and simple maintenance, the Dimensionair more than justifies its place in your production.

Don't take our word for it — or anybody's — take your own. Try it, buy it and use it. You'll insist that the next gage will be a Dimensionair, too. Just ask us for a chance to operate one.

FEDERAL PRODUCTS CORPORATION
5113 Eddy Street, Providence 1, R. I.



FOR ANYTHING IN MODERN GAGES ...

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automatically Controlling Dimensions on Machines

accurate CINCINNATI

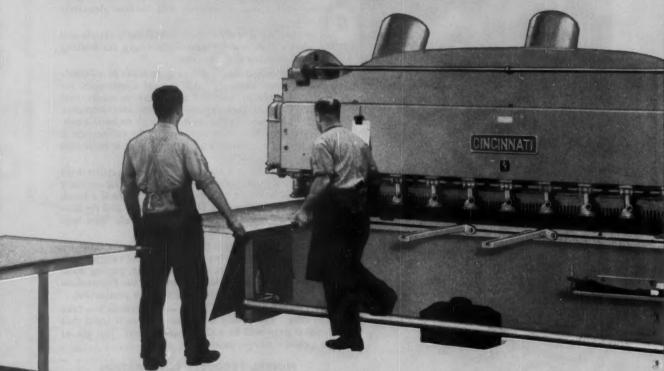
shearing from

20 GAUGE SHEETS

to 5/16"

...with ONE knife setting

... SPEEDS PRODUCTION



Photos courtesy Binks Manufacturing Company, Chicago, Illinois



THE CINCINNATI SHAPER CO.

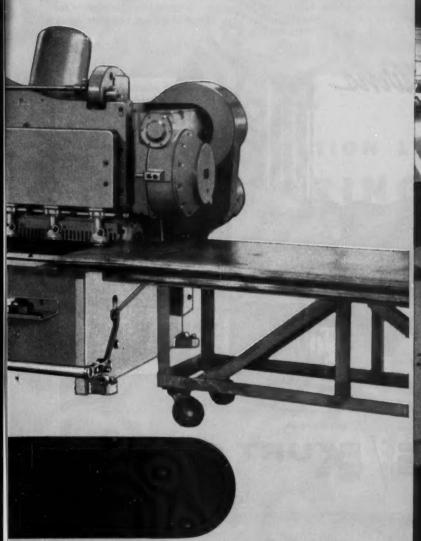
CINCINNATI 25, OHIO, U.S.A.

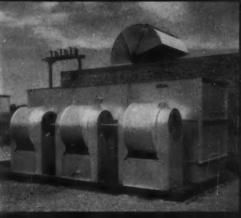
SHAPERS . SHEARS . BRAKES

Here 20 gauge to 16" plate is sheared with no change of knife clearance—a time saving and production increasing feature.

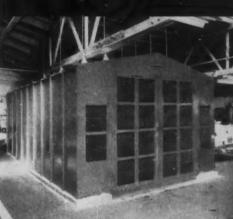
The Binks Manufacturing Company say this Cincinnati Shear is a very accurate machine and a most profitable investment.

Write for Catalog S-6.

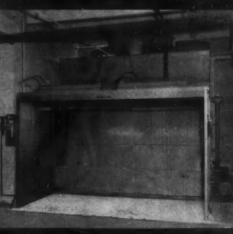




Water cooling tower



Dry auto spray booth



Water wash spray booth

this 140-TON horizontal milling machine

There's never been one like it before!

Just a press of a button puts this mighty Schiess into action. A 25-ft. high column moves smoothly along 45-ft. long bedways. Never a vibration—no chatter—even at maximum transversal loads! The new Schiess design of the spindle heads has eliminated this!

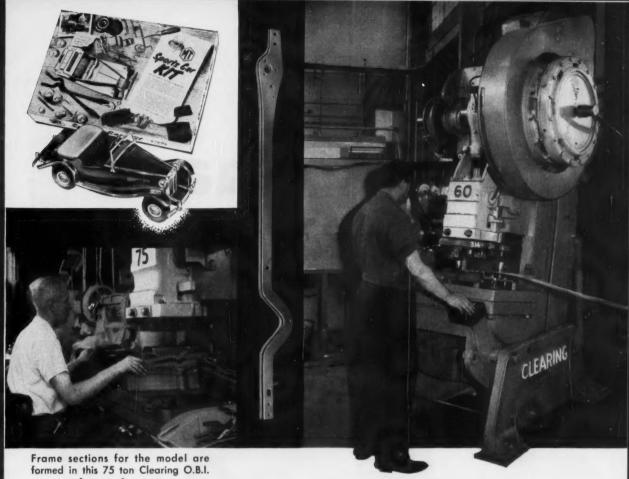
THE MILLING OPERATION. A huge tungsten-carbide cutter in a 14¼" spindle goes to work on the stock. And performs its operation with a consistent accuracy—a surface-finish count—never before obtainable on such a big fellow.

THE BORING OPERATION. Another press of a button! Another spindle goes to work—bores a 79" depth in one cut—or a total depth of 118". Boring and milling spindles are provided with 36 speeds of which the top 12 are V-belt transmitted. Rapid traverse, feeds and manual controls of the two spindles are completely independent.

That this mighty machine has tremendous productive capacity is self-evident. And its productivity goes far beyond conventional milling and boring. Schiess attachments increase its scope to taper-milling, thread-cutting, copying and, in certain instances, copying in 3 dimensions. It's a time saver, too. Can go from feed to rapid traverse immediately, without complicated adjustments.

The Schiess Model FB 36/22.5 Horizontal Milling and Boring Machine is a product of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess Engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all five FB models.







PRODUCTION LINE

Uses CLEARING O.B.I.'s

The MT sports car kit produced by the Doepke Mfg. Company is designed to make dad's eyes sparkle even more than Junior's. In this authentic scale model, parts are made of heavy gauge steel to simulate the larger components of full size cars.

Just as in large automobile plants, efficient mass production makes it possible to put out a product the public can afford to buy. That's why Clearing O.B.I.'s are a major factor in Doepke's manufacturing system.

If you want to make your production a model of efficiency, let a Clearing engineer discuss your plans with you. Call or write today.



CLEARING PRESSES

CLEARING MACHINE CORPORATION

DIVISION OF U.S. INDUSTRIES, INC.

6499 WEST 65th STREET . CHICAGO 30, ILLINOIS HAMILTON PLANT . HAMILTON, OHIO

CEC

The only gravity drop hammer with short stroke control

CHAMBERSBURG

THE HAMMER BUILDERS

CHAMBERSBURG ENGINEERING CO.



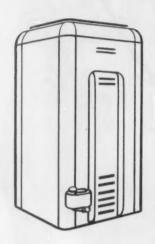
CHAMBERSBURG, PENNSYLVANIA



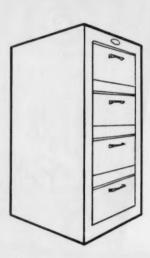
Speed your production as this

with DUOTONE

by Lowe Brothers







A large manufacturer of theater seats wanted to step-up production of seat backs by eliminating back-tracking and double-handling in the finishing process. Lowe Brothers "Finishing Specialists" developed an amazingly fast spraying, solid covering (one coat!), quick setting enamel for his product. Besides greatly speeding the flow of finished parts, this sensational new finish—Duotone Enamel—provided the best looking, longest wearing, most economical finish this manufacturer had ever used!

New Duotone Enamel is the ideal finish for a broad range of sheet metal products. It gives maximum beauty and wearability, yet keeps finishing costs at a minimum!

This advertisement is based on facts from Lowe Brothers Case History files.



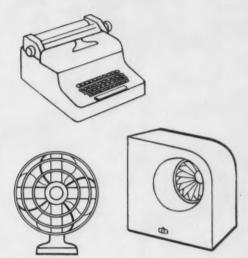
ENGINEERED QUALITY

manufacturer did...

ENAMEL

Extremely fast baking! Amazingly tough!





Check these important Duotone Enamel features • Dries in 15 minutes at 300° in a conventional oven—and in 8 minutes under infra-red! No orange peel! • Available in any degree of gloss—wide color choice. • It's a modified alkyd resin type enamel. • Sets a new standard for wearability! Practically impossible to mar or scratch! • Resists perspiration and skin oils. • Duotone keeps material cost to a minimum! Just one coat (only ½ mil thick) covers bare metal surfaces perfectly with an adequate protective film . . . Duotone may save you plenty in 1955! You pay nothing to find out. Write today for the full story.

The Lowe Brothers Company • Dayton 2, Ohio • Industrial Division

LOWE Brothers
FINISHES FOR INDUSTRY SINCE 1870

District Offices: Atlanta • Boston • Dallas Chicago • Jersey City • Kansas City

LOOK TO THIS NEW, PRODUCTION-BOOSTING LINE

NIAGARA

SC2-300-60-48



NIAGARA
WACHINI & 1001 WOLLS
75

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal World

For a realistic answer to the metal stamping and forming problems of today... and tomorrow

DESIGN MODERNIZATION CONCEALS DRIVING MECHANISM

Fully streamlined, enclosed construction, front and back, provides pronounced advantages. There are no exposed, overhanging flywheel, clutch, brake, intermediate shaft, nor motor in rear of press to obstruct crane service, block light, throw grease and consume floor space unnecessarily ... yet all parts are quickly accessible.

WORK-SAVING FLEXIBILITY MEETS SHIFTING PRODUCTION NEEDS

Box type welded steel slides are power adjusted through self-locking, worm driven, barrel type connections to accommodate a wide range of die heights and to permit quicker, easier and safer die setting. Niagara electric clutch control provides trouble-free push button operation and a five-position selector switch for ease, safety and efficiency in single stroking, continuous running, jogging, reverse jogging and slide adjustment.

RUGGED, HEAVY DUTY FRAMES PROLONG DIE LIFE

All-steel, rigidly constructed frames, featuring an exclusive triple box section design, provide maximum resistance to deflection from horizontal, diagonal and torsional stresses. Greater accuracy and longer die life are thereby assured.

GREAT SHUT HEIGHT AND LONG SLIDE ADJUSTMENT

Unusually liberal shut height and extremely long slide adjustment, of both one and four-piece frame construction, permit use of a tremendous range of stamping and forming dies. Hailed as the most progressive step in straight side, double crank press history, the new Niagara SC-2 Press Series could only have originated from a keen insight of today's metal working problems and the more challenging ones of tomorrow. In every detail of design, you'll recognize the unduplicated competence of Niagara engineers. Who else would be more mindful of press users' needs than the men who design and build America's leading and most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work?



CHECK THE FEATURE-BY-FEATURE EVIDENCE

Preview this complete new line of straight side presses at once. Find out what they can do for you. Write for Niagara's new, illustrated Bulletin 64-H today.

NIAGARA MACHINE & TOOL WORKS BUFFALO 11, N. Y.

DISTRICT OFFICES:

Buffale Cleveland Detroit

New York Philadelphia

Dealers in principal U.S. cities and major foreign countries

NIAGARA

STRAIGHT SIDE DOUBLE CRANK PRESSES



PARALLOC
Dial Snap Gages

With a remarkable new type of pin locking mechanism that minimizes "out-of-parallelism" between anvil faces. "L" Type fully encased, with set-back indicator and handle, permitting entry into narrow recesses. Wide choice of indicators as for "D" Type.



"L" (LEVER) TYPE

8 SIZES, each with $\frac{1}{2}$ " range, cover over-all range 0" to 4"



8 SIZES, each with 1" range, cover over-all range 0" to 8"

DuBo®
Plug
Gages

SINGLE END Sizes over 1.510"

DOUBLE END Sizes under 1.510"



will drop freely or not shows "Go" or "NoGo". Finger-

tip operation reveals internal bore conditions by sensitive "feel". Tells more, more easily, than ordinary plug gages. DIAL Bore Gages

10 SIZES

cover range from

1/8" to 24"

PATENT APPLIED FOR

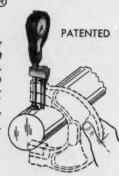


Three new models extend dial bore gaging range by intermediate steps down to ½" diameter. Each utilizes STAND-ARD's new, highly practical CENTERING-SIZE DISC principle. Simple in design, easy to set, easy to use; amazingly accurate and effective in small bore gaging.

Dializers®

STANDARD's original device for converting AGD Adjustable Limit Snap Gages to DIAL Snap Gages. Wide range of indicators from 11/8" to 21/4" diameter, graduations of .001", .0001", .0005" and .00025", and a wide variety of dial markings, including metric.

Available separately for your frames or assembled in AGD frames supplied by us.



DIAL INDICATORS



A complete range of sizes and mountings, with any desired graduation; regular, metric or Decimatic . . . all completely shockproof.

EFFICIENCY

EASE OF HANDLING

EASE OF READING

LONG SERVICE LIFE

LONG SERVICE
REDUCTION
OF FALSE
REJECTS

Write for "NEWS"; get full details of new STANDARD instruments that speed production and save you time, money and worry.



86-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257

How the Morgan Engineering Company reduces their cost savings opportunities to careful analysis

ME	SHEET SEE REVERSE SIDE FOR OTHER CALCULATIONS				3/54	
			Number 10			
ME						
	Susject of Analysis Replacement of Old Lathe With One New Ar					
	Modern Forret Lathe.	Sodern Tourses Latines				
	Assumed MATE OF PRODUCTION Proposed equipment will reduce present required time 35%.					
	PRESENT EQUIPMENT - DEFENDER	PRO	PROPOSED EQUIPMENT - CHALLENGER 28-1/4* Swing - 8* x 51* Bar Capacity			
	24" x 58"	1				
A/W	With 8" Bore	Swing				
			,	-		
,	Machine 669 Punchases 1942 Seunce					
	LOCATION Dept. 9352 (001 16,072,00 SEFF 8'37638.25 101 17,000,00 101 18,6				*38,638,2	
	SALVAGE OR	ESTIMATED	Estimates Estimates			
3	Disposat Sell Convertion1,500,00	PRIMARY SERVICE LI	12	SALVAGE 8	5,000,00	
	OPERATIONAL NEXT-YEAR ADVANTAGES	A	DEFENDER		8 CHALLENGER	
9		DEFE				
	(DIFFERENCES)					
	INCOME ADVANTAGES	TOTAL	ADVANTAGE	TOTAL	ADVANTAGE	
A/B		1	•	8		
	INCREASED OUTPUT.	+	-		1,244,00	
1	OTHER	-				
	OPERATING COST ADVANTAGES	10,170,00		5.655.00	4,535,00	
	DIRECT LABOR. INCL. OVERTIME & SHIFT PREMIUMS	- and all states			-	
	SET-UP TIME					
	"FRINGE" LABOR COSTS	2,521,70			2,521,70	
,	ORDINARY MAINTENANCE	2,000,00			2,000,00	
	SPECIAL REPAIRS	3,500,00			3,500,00	
	Tool Cos7s	298,00	2,685.00	2,983,00		
1	Supplies					
	DEFECTIVE MATERIAL . REMORK	-				
	SPOILAGE . SCRAP	473,80	-		473-80	
	DOWNTIME - OUTAGE	222,90	222,90	145.90	44 Jain	
	POWER CONSUMPTION		WEWE/9			
	PROPERTY TAXES AND INSURANCE	77.13	299.38	376.38		
,	Sua Contract Costs	1110	-,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	7,200		
	OTHER					
	TOTALS	119263.53	13,207,28	8 9 1,60 1,3	874, 254, 50	
	DEFENDER OPERATING INFERIORITY (NET CHALLENGER A	DVANTAGE 328 -	- 32A		11.0h7.22	
	ADVERSE MINIMUM - DEFENDER	A	ADVERSE MINIMUM - CHALLENGER			
	OPERATING (MYSERSON TO CLUME 88) 8 11,047,22	Coat leave	ALER STOTAL S		38,638,25	
	SALVARE VALUE 1000, MENT 7440 8 300.00	PRIMARY 11	(1		12 Tears	
	Traces - 7 . (1 1101 0a) 4 105.00 Traces talvate valve (00) 4 5.000.00					
					11	
	MEST TEAR PROBATION \$	_ CHART 10	Creat 10 ser. 7 a ferat 17:			
	INTEREST # (x LINE 504) \$	TOTAL % 1	Total & 1 Cost Installed (300 1 300) 6,568.50			
	Total, Outstice Line 38 mm	BREWAL AV	ERASS .			
	22 1 /2 22	PERLOD	C CAPITAL ACT		6 110 10	
	ADVERSE MINIMUM \$ 11,452,22	ADVE	ADVERSE MINIMUM (408 + 418) \$ 6.568.50			

Statement
from the
Morgan
Engineering
Company

"We consider a sound program of machinery and equipment replacement to be one of the most essential functions of our manufacturing operations."

WILLIAM H. MORGAN President, The Morgan Engineering Company

GAIN from replacement by the Morgan Engineering formula is

- . . . after required interest or return on the new investment
- . . . after full allowance (by the formula) for future obsolescence of the new equipment

Keep gathering metal-working production ideas . . . be well informed when the time for replacement arrives.

Analysis sy R. W. Corll

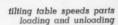
ROCKFORD INSERT GROUP

March, 1955.

MORE EFFICIENT BROACHING ...

the American way

pawl slot and cam contour broached simultaneously



A cam contour and slot in the pawl of a forged, parking brake part are broached simultaneously in this two-station American broaching machine. Note that the broached surfaces are in different planes. To increase operator efficiency, the two-station fixture tilts back within easy reach for quicker, easier unloading and reloading. At the end of each cycle, part with slot broached at the left hand station is transferred to the right hand fixture for cam contour broaching and the left hand fixture is reloaded with a rough forging.

Push button starts the cycle, hydraulic clamps automatically clamp part and table tilts forward for broaching stroke. The cam contour and slots in the pawl of the part are broached simultaneously. The table then tilts back to loading position where parts are automatically released. Production: 150 parts per hour.

Whether you have a single parts surface or multiple surfaces to broach, American engineers will furnish the right combination of machine, tool and fixture design. Why not put American's 35 years of experience in this field to work on your broaching problem. Send a part print or sample with details of your production requirements. Recommendations showing the American way to do the job will be furnished promptly.

American equipped this machine with extra long broach sections because of the considerable variation in parts dimensions encountered. Oversize parts are broached without overloading.



American Building - Ann Arbor, Michigan

See American First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



Machinery, March, 1955

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

SUNDSTRAND

peed and Uccurace



FACE MILLS





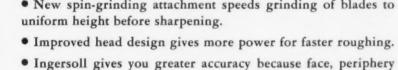
serted blades.





• The Ingersoll Cutter Grinder processes cutters in 1/2 to 1/3 the time required on ordinary equipment.

and corners are ground in a single setting.



• New spin-grinding attachment speeds grinding of blades to uniform height before sharpening.

• In addition to those shown here, the versatile Ingersoll Cutter Grinder sharpens a wide variety of 4" to 30" diameter milling cutters with high speed steel, cast alloy or carbide-tipped in-



Write Today for Cutter Grinder

> Manual 64B.

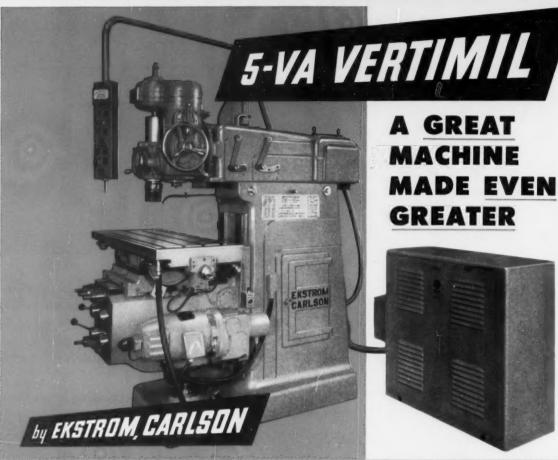




BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES ORIGINATORS OF SHEAR CLEAR CUTTERS

THE





Electronic INFINITELY-VARIABLE FEEDS INCREASE VERSATILITY TREMENDOUSLY

Here is a really outstanding Vertical-Spindle Milling Machine — for toolroom, job shop, and production use. Newest improvements include electronic controls that give continuously-variable feed ranges of .250" to 100" per minute on longitudinal and cross travel of the table, and from .070" to 38" per minute on vertical travel of the knee; both in two simple stages. A new pendant, convenient to the operator, carries all the control buttons, and the feed-setting arrangements and indicator. New gear-control levers on the knee improve the convenience and efficiency of set-up

and operation. All in all, this great machine is *bard to beat* by the most up-to-date of modern standards. Let us tell you more about it . . . write for full information.

Left, picture shows extreme positions. Table tilts 30° either forward or back, spindle swings 45° to either side.





1400 RAILROAD AVE., DEPT. M-4, ROCKFORD, ILLINOIS

Manufacturers of Machinery and Tools Since 1904



Left, the control pendant has a feed-rate indicating motor at the top, a moster stop stick at the bottom, and all vital operating control buttons and selec-

tion switches on the panel.

front of the knee to save

the operator a lot of

reaching around.







BARNESDRIL UNIT MACHINES

guarantee controlled production rate

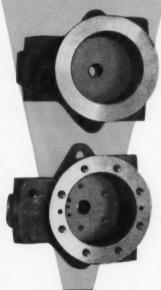
to give you lowest possible cost per piece



a typical example

BARNESDRIL Special **Drum-Type Unit Machine** drills at the rate of 12" per minute, with cluster-type heads operating high speed steel cutting tools at maximum speeds. Fifty-seven different holes in 14 sizes ranging from .062" to 1-3/8" are drilled, tapped and chamfered in a 20 second machining cycle - 180 pieces per hour.

> send for complete catalog bulletin 1505



BARNESDRIL

Cut costs on your
machining operations by
combining as many primary
and secondary operations as
possible in one machining
cycle on a BARNESDAIL Unit-Machine.
The cycle is engineered to
give you the number of
pieces per hour required to
meet your assembly needs.

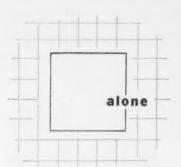
This machine is a typical example of applied BARNESDRIL engineering experience in combining a wide range of production operations into a single automatic cycle.

DETROIT OFFICE 3419 South Telegraph Road, Dearborn, Micha

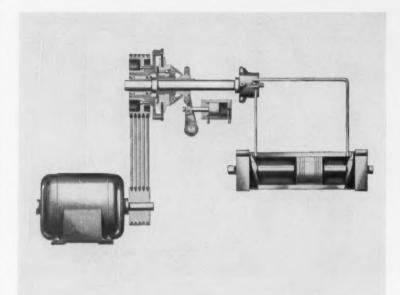
BARNES DRILL CO.

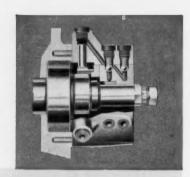
820 CHESTNUT STREET . ROCKFORD, ILLINOIS





closed fluid circuit BARNES with intermittent drive and control

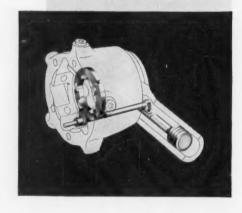






Fluid power circuit associated with automatic clutch arrangement including a rotary driving means, a variable flow displacement pump driven by the driving means, fluid power action for controlling the clutch arrangement, a fluid motor of the piston and cylinder construction including responsive fluid pressure arrangement within the fluid motor for determining the starting and stopping of the rotary driving means in synchron-ized relation with direction of travel of the fluid motor.

Result automatic and positive control of the rotary driving means and a predetermined amount of travel of the fluid motor for each revolution of the driving means—irrespective of the amount of resistance encountered by the fluid motor.



BRANCH

DFFICES

503 New Center Building
Detroit 2, Michigan
3234 Lincoln Avenue
Chicago 13, Illinois
132 East Hanover Street
Trenton 8, New Jerrey

REPRESENTATIVES

SALES
Rees Machinery Company
1012 Empire Building
Pittburgh 22, Pennsylvania
171VES
B. W. Rogers Company
850 South High Street
Akron 9, Ohio

Standard Machine & Tool Co. 870 Ottawa Street Windsor, Ontario, Canada W. H. Del Mar Co. 3931 W. Slawson Ave. Los Angeles 43, California

JOHN S. BARNES CORPORATION



Copyright 1953 by John S. Barnes Corporation

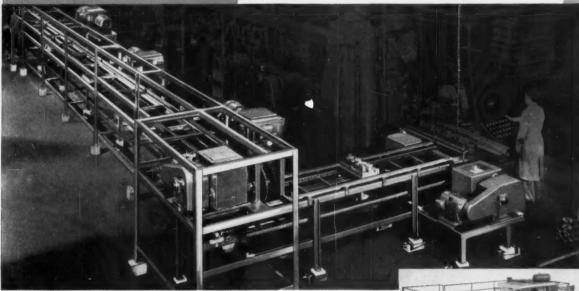


Machinery, March, 1955

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

Now Available

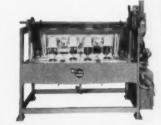
A Special AUTOMATION EQUIPMENT Designing and Building Service



OMPLETE facilities are now provided by the Process Equipment Division of the W. F. & John Barnes Company for the designing and building of standard and special automation equipment. Widely experienced in this specialized field, Barnes have developed many units, both large and small, which are now successfully and profitably cutting work-handling costs and increasing production output in hundreds of industrial plants. The three units illustrated are typical of the broad range and variety of thousands of methods and processes developed by the Barnes' Process Equipment Division.

Here at Barnes, you'll find the varied engineering and creative skills, plus over 75 years of machine building background, to help you solve many troublesome production problems. And because all planning, engineering, and manufacturing efforts are closely coordinated, you have available a complete Automation Equipment Service from one convenient source.

ASK FOR AN ANALYSIS OF YOUR WORK-HANDLING METHODS Find out how these unique creative and specialized resources can help you cut costs. Your problem will be given expert and individual attention. ▲ Many progress-thru type machine tools employ special conveyors to return the workholding fixtures to the loading end of the machine, as shown above. Barnes conveyors are designed to do this work automatically, in cycle with the machine, to greatly reduce work-handling costs.



▲ Another Barnes unit designed to speed work-handling is this special two-carriage automatic loader and unloader for handling heavy railroad axies before and after machining. Smooth, accurate traversing of the carriages is accomplished with a special electrical slow-down circuit.

▲ This special semi-automatic testing machine was developed by Barnes to test for leaks in automative power steering castings. It handles four workpieces per cycle. Except for loading and unloading, all operations are performed automatically.

Free BOOKLET

Write today for your copy of "Coordinated Creative Engineering and Manufacturing" — a 32-page booklet crammed with cost-cutting Automation Equipment ideas.



W. F. & JOHN BARNES COMPANY PROCESS EQUIPMENT DIVISION

416 SOUTH WATER STREET . ROCKFORD, ILLINOIS

BUILDERS OF BETTER MACHINES AND EQUIPMENT SINCE 1872

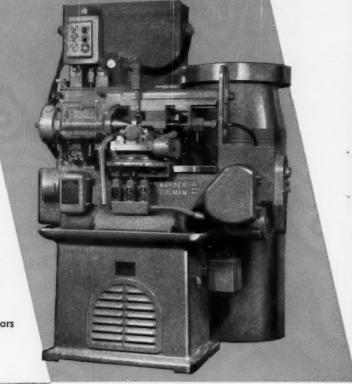


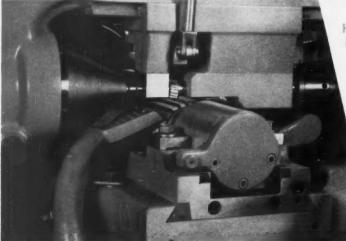


Fully Automatic GEAR HOBBING

offers
new low costs
on gears
16 pitch or finer

As more and more gear operations are modernized to place them on a competitive basis, automatic gear hobbing equipment becomes an essential approach in reducing gear costs. Since 1937 Barber-Colman engineers have been working closely with major gear producers in the application of automatic gear hobbing. At first, automatic hobbing applications were made in the watch gear and instrument fields. Later, machines were built for medium pitches in other fields, such as fishing reel gears. Now this latest Automatic No. 6-10 Hobbing Machine is designed specially for cutting automatic transmission and speedometer gears to meet the required rate of production on an automatic production line.





High-Production Plant Reports Savings In Unit-Costs with Fewer Gear Rejects

In this particular production plant, fewer gear rejects are occurring. An overall reduction in cost per gear has been effected through reduced man-hours and continuous high-speed output.

One of a battery of machines performs as follows:

Automatic Cycle — 356 Hob RPM, 175 Hob SFM. .050" feed per rev., 60-second complete cycle time.

Transmission Gear — 16 teeth, 18° 30' helix angle 18 DP., SAE 1330, .937" OD. x 5%".

Class C Accurate Unground Hob 1%" dia. x 3" face x ¾" bore, 1 thread, unground, pre-shave.

Completely Automatic Cycle Provides Continuous High-Speed Gear Cutting

Blanks are automatically loaded through a hopper-feed system and positively located and clamped hydraulically on a solid arbor in cutting position. The cycle sequence includes rapid traverse to the hobbing position, lowering of the work slide to cutting depth, hobbing the blank, raising the work slide, rapid traverse to the right, and unload. A new blank then is automatically presented for hobbing and the cycle repeated continuously until the machine is shut off.

Machine features include automatic hob shifting for greater tool life and metered hydraulic pressure for positive arbor mounting and ejection. Rapid traverse is actuated electrically, and the work slide is hydraulically actuated.

BUILDERS

0 F

PRECISION

GEAR



Adaptable to Wide Range of Long-Run, High Speed Gear Production.

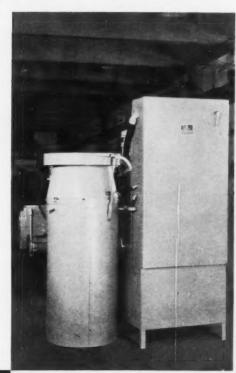
This type of cycle arrangement is adaptable to many similar long-run gear cutting operations within the general range of 16 pitch and finer, depending upon the particular gear specifications. The cycle is arranged to suit the requirements of the job, and tooling, feed, speed and cycle-timing will depend upon the required production and gear specifications.

Positive Control Over Gear Accuracy Through Automatic Arbor Loading.

Barber-Colman automatic hobbing supplies positive gear accuracy control through specially developed tooling which mechanically mounts blanks solidly upon the work arbor prior to cutting. This arrangement eliminates chances for looseness, runout or vibration likely to occur in other types of mounting. Work arbors are designed for positive pick-up and location of the blank.

Cycle Fully Protected by Automatic Stops.

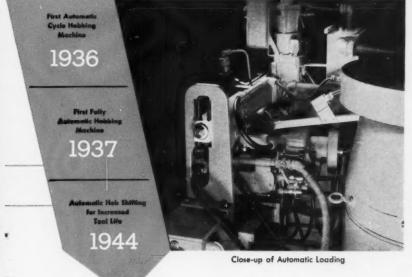
A combination of electric limit switches, program motor and mechanical movements governs the cycle. Faulty blanks are automatically rejected if presented for hobbing, and the machine is under complete control at all times.



Rear View Showing Automatic Loader and Electrical Panel

Engineering Service Available Without Obligation

Check your high production gear operations to determine whether you are maintaining a competitive cost basis. Barber-Colman engineers will gladly consult with your gear production people to demonstrate the cost-saving benefits of automatic hobbing. Ask your Barber-Colman representative to arrange an appointment for you, or write directly to Automatic Hobbing Engineering. No obligation!



HOBS • CUTTERS • REAMERS

HOBBING MACHINES

HOB SHARPENING MACHINES

nd,



Barber-Colman Company

GENERAL OFFICES AND PLANT,

623 BOOK STREET, BOCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911



Downtime BECOMES

Production Time

with the

NEW MATTISON DUPLEX

7ake a look at THIS

- 2 Operators
 2 Standard Grinders
 500 Pieces
- 1 Operator 1 Mattison Duplex 500 Pieces
- That's what happened at The Ingersoll Milling Machine Co., where modern shop equipment is playing an important part in meeting greatly increased requirements for Ingersoll milling cutter blades.

They say "The pieces being ground in these pictures are Maxel steel shanks for carbide-tipped milling cutter blades.

On these particular blade shanks, .050 stock is removed on the Mattison Duplex. A wide variety of blades and shanks are ground on this machine, with stock removal ranging from .020 to .200.

The two Mattison Duplex machines which replaced three single-table standard type grinders are doing more work than the three replaced machines. By placing a single ring of blades around the outside of the 30" diameter chuck, the operator is able to maintain continuous grinding. If more blades were put on the table at one time, the blades on the other table would be finished before he was ready to unload them.

The time saving in rough grinding these blades on the new Duplex machines is 50 per cent, compared with the old machines. In other words, 500 blades can be produced in half the time formerly required. Greater power and faster action account for some of this difference.



The new Mattison Duplex Grinder is really two machines in one, being equipped with two rotary tables or chucks instead of one. On many classes of work, one operator with this machine can turn out as much work as was formerly done by two machines and two operators. See example to the left. Downtime is practically eliminated.

An analysis of your grinding work will very likely disclose many jobs that could be very profitably handled on a Mattison Duplex. For further information write for a free copy of 145-3RM our new circular on this machine.

MATTISON

MACHINE WORKS

ROCKFORD · ILLINOIS



Machinery, March, 1955

CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

GREENLEE TRANSFER MACHINES

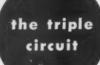
In the course of pioneering development of automatic transfer machines for mass production since 1935, Greenlee has introduced various outstanding elements and methods...

- Mechanical Features, such as: a raise-andcarry transfer system, patented individual lead screw tapping, automatic chip removal, all heads designed for preset tools, accessibility of all stations, and hardened and ground steel ways.
- JIC Standards throughout, on all hydraulic, electrical, and air-operated units.
- Workpiece automatically handled through all stations.
- Safety provisions, including electrical interlock of all units.
- Automatic lubrication, selected for each part of the machine.

GREENLEE BROS. & CO., 1863 Mason Ave., Rockford, Illinois







high speed Tension To pump

Compression Double acting cylinder

From pump

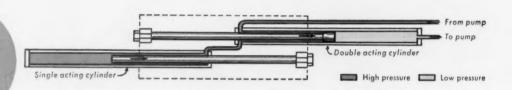
PLANER TABLE

CUT→

medium speed Double acting cylinder

Single acting cylinder

S D B B d



Infinite Speeds from 10 to 300 fpm. stepped through 3 distinct cutting force ranges.

Pendant control of range and cutting speed selection.

Maximum return speed regardless of cutting speed.

Quick reversals with minimum overtravel.

Suitable for prolonged use on short stroke work, as well as long work.

Hydraulic drive and feed has long provided efficiency and ease in the planing and shaping of metal.

Now a singular new dimension has been added to the proven efficiency and economy of Hydraulic planing. The new Triple Circuit provides the correct combination of cutting speed and required force, to most economically machine materials from the free cutting types to the toughest steel.

Many plants, large and small, who are evaluating their present equipment will find the Triple Circuit a significant development in their plans for plant modernization.

Get full details on this new Hy-Draulic achievement from any Rockfod Machine Tool Co. Representative, or write directly to us.



ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET

ROCKFORD, ILLINOIS



Machinery, March, 1955

CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

REHNBERG-JACOBSON

RIM-BALL

INDEX TABLES

WILL TAKE GREAT WEIGHT

EXTREMELY RIGID

COMPLETELY
SELF-CONTAINED

RIM-BALL BEARING

EIGHT SIZES 54", 48", 42", 36", 30", 24", 20", 16"

3 TO 12 INDEX
POSITIONS

(54"-48" minimum 5 Positions)



16



USE THEM IN MANY WAYS ...INSTALL THEM YOURSELF

It is hard to suggest all the possible ways you might use these index units. In addition to many conventional methods of horizontal mounting, they may also be set vertically to act as face plate or trunnion arrangements. Work-holding fixtures of almost any kind can be attached as desired. The RIM-BALL bearing enables the table to support great weight, yet turn easily, and it also eliminates any tendency for the table to tip or twist. A fixed center post, as shown above, can be furnished if wanted. Rehnberg-Jacobson Index Tables are shipped completely assembled and tested, ready for you to install by simply bolting down the base flange and mounting the drive motor. Complete data sheets showing dimensions of all models are available, and will be sent promptly on request.

Designers and Builders of Special Machinery

REHNBERG-JACOBSON MANUFACTURING COMPANY



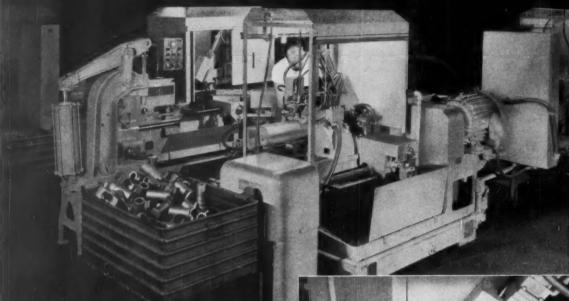
2135 KISHWAUKEE ST.

ROCKFORD, ILLINOIS

Machinery, March, 1955



Turning Time Cut From 4 ½ to 2 Minutes Per Piece



With a SUNDSTRAND
Automatic Lathe Equipped
With Automatic Multi-Cycle
Tracer Control

Various sizes and types of Universal Joint parts are turned on these Sundstrand Automatic Lathes equipped with Automatic Multi-Cycle tracer control. On one lot of parts, machining time was cut from 4-1/2 to 2 minutes per part.

Savings on other sizes of parts are comparable.



Two Sundstrand Automatic Lathes with automatic multi-cycle tracer control for machining Universal Joint parts.
Inset: Close-up of tracer control.

The lathe is also equipped with adjustable facing attachment for chamfering or undercutting. These high producing Sundstrand Automatic Lathes are easily changed over for handling the various sizes of parts.

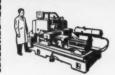
AUTOMATIC LATHES , SIMPLEX RIGIDMILS , DUPLEX RIGIDMILS

SUNDSTRAND

"Engineered"

Production

Service*









Machinery, March, 1955

CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.



Unit Produces Ruff, Semi-Finish and Finish Cuts In One Automatic Cycle

With this attachment and controls, ruff, semifinish and finish cuts can be taken with one turning tool in one automatic cycle. The control can be set up for one, two or three cycles depending on stock removal and job requirements. The regular cross feeding rear slide can be used to square up shoulders, chamfer, etc. Cycle changing is quick and easy, usually 15 minutes or less, with actual time dependent on the number of facing tools required in the job setup. Illustrated above are typical parts turned at Mechanics Universal Joint Division, Borg Warner Corp., Rockford, Illinois, using Sundstrand Automatic Lathes equipped with the new Sundstrand Multi-Cycle Tracer Control. The Universal Joint parts illustrated are just a few of many that can be turned efficiently on this equipment. The diameters and tapers are turned with simple single point tools. Small lots or large can be handled easily and quickly.

features

- 1. Easily changed over for different jobs.
- 2. One template for all three cuts.
- 3. Change-over time to standard operation approximately 45 minutes.
- 4. Three turning cuts in one automatic cycle.
- 5. Cross feeding rear slide operates in automatic cycle for facing, grooving, chamfering, etc.
- **6.** Because of the complete automatic cycle, one operator can run several machines.

Free Data

Additional information is available in this new folder. Write for your copy today. Ask for bulletin 653.



TRIPLEX RIGIDMILS

SPECIAL MACHINES





SUNDSTRAND Machine Tool Co.

2530 Eleventh St. . Rockford, Ill., U.S.A.

Machinery, March, 1955

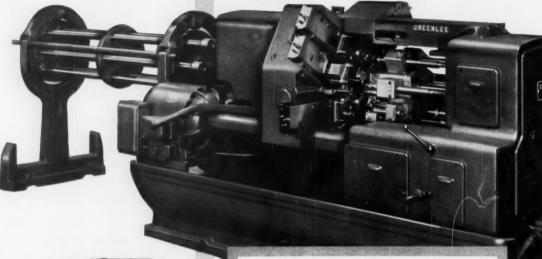




AUTOMATIC BAR MACHINES

INCREASE YOUR PRODUCTION...
LOWER YOUR COSTS!

CUT YOUR SET-UP TIME
SPEED-UP DIFFICULT OPERATIONS



GREENLEE 4-SPINDLE AUTOMATIC SPECIFICATIONS

Rating	2-5/8"
Chuck Capacity, Round	2-5/8"
Chuck Capacity, Hexagon	2-1/4"
Chuck Capacity, Square	1-7/8"
Stock Feed	8-3/16"
Turning Length	7-1/2"
Spindle Speed Range	120 to 1200
Feed Range per Spindle Rev	.002 to .0458
Mater Herse Power	20
R. P. M. of Motor	1800
Floor Space:	
Length with Stock Reel	17'-3"
Width	5'-4"
Height	
Net Weight in Pounds	17,000

GREENLEE 6-SPINDLE AUTOMATICS

SPECIFICATIONS

Rating	1"	1-5/8"	2"
Chuck Capacity, Round	1"	1-5/8"	2"
Chuck Capacity, Hexagon	7/8"	1-13/32"	1-3/4"
Chuck Capacity, Square	3/4"	1-1/8"	1-7/16"
Stock Feed	6-3/16"	8-5/16"	8-5/16"
Turning Length	6"	7-1/2"	7-1/2"
Spindle Speed Range	225 to 2500	105 to 2175	95 to 1935
Feed Range per Spindle Rev.	.0014 to .0218	.0017 to .0388	.0019 to .043
Motor Horsepower	15	20	25
R. P. M	1800	1800	1800
Floor space:			
Length with Stock Reel	17'-6"	17'-3"	17'-3"
Width	5'-0"	5'-4"	5'-4"
Height	4'-11"	5'-4"	5'-4"
Net Weight in Pounds	14,400	17,940	18,150

GREENLEE 2ND OPERATION AUTOMATIC



Extremely versatile, high-production machines. Parts can be loaded semi-automatically or fully automatically. Incorporates the same basic features . . . inherent production and operating advantages as the standard 6-Spindle Automatics.

INVESTIGATE NOW

PHONE ROCKFORD, ILLINOIS 3-4881



GREENLEE BROS. & CO.

1863 MASON AVENUE ROCKFORD, ILLINOIS



Machinery, March, 1955

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.



used - as it has been for over half a century.

It's easy to prove the superiority of REX. Use it on the job...check its size, structure, response to heat treatment, fine tool performance. You'll agree with thousands of other users-you can't find a high speed steel to outperform REX.

Remember, REX is made only by Crucible. So call for REX at any Crucible warehouse, or for quick mill delivery. Crucible Steel Company of America. Henry W. Oliver Building, Pittsburgh 30, Pa.

Visit us at Booth 350 Western Metal Show Los Angeles - Mar. 28-Apr. 1

first name in special purpose steels

Company America Steel

For more information on products advertised, use Inquiry Card, page 257

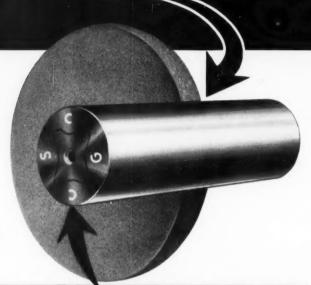
MACHINERY, March, 1955-103

An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight, smooth & really accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is carefully tested before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845

INCORPORATED 1892

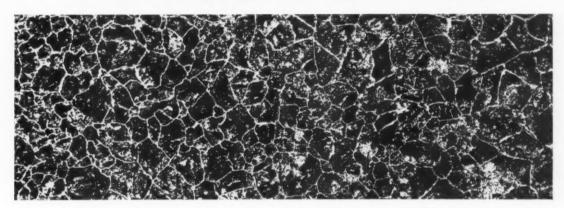
104-MACHINERY. March, 1955

For more information on products advertised, use Inquiry Card, page 257

INDIVIDUAL HANDLING... one good reason



TIMKEN® forging steels give uniform



grain size order after order

THERE are good reasons for the uniform grain size in every piece of Timken® forging steel, as shown in the photomicrograph above. And good reasons, too, why you get the grain size you want order after order.

Your order for Timken forging steels is handled individually in our mills and we target conditioning procedure to your particular forging requirements. In the top photo, a billet is stamped to identify the heat and ingot it came from—one way we can make sure you get uniform grain size from shipment to shipment.

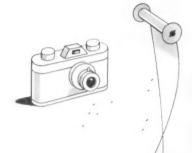
Uniform grain size after heat treatment is assured by spectrometric or microscopic examination of every heat. The result—you can be sure that forgings made from Timken forging steels have uniformly high ductility and resistance to impact.

You have fewer furnace temperature adjustments when you use Timken forging steels. Every lot responds uniformly to heat treatment because every lot has the same physical and chemical properties. Always specify Timken forging steels. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

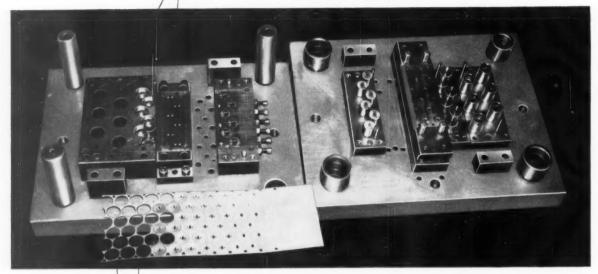
YEARS AHEAD-THROUGH EXPERIENCE AND RESEARCH



SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING



Over 150 Million Stampings from this **ONTARIO** Die







ONTARIO BLUE SHEET

A concise 4-page booklet of facts on the handling and shop treatments of Ontario. Included is complete information on forging, annealing, tempering, etc. and detailed laboratory data on physical characteristics. Ask for your free copy.

Address Dept. M-63

600,000 Film Spool Flanges PIERCED, EMBOSSED, STAMPED and BLANKED per Grind

Production engineers at an eastern camera manufacturing plant have reported excellent results from their Ludlum Ontario film-spool-flange die. The Ontario die performs the multiple operations of piercing, embossing, stamping, and blanking.

Operating at 130 strokes a minute, the big die has produced over 150,000,000 parts. Runs as high as 600,000 have been made between grinds. For this operation, Ontario is air cooled from a temperature of 1850 F, then tempered at 350 F for six hours. This results in a Rockwell C hardness of 60-62.

Ludlum Ontario is an air hardening die steel of the high carbon/high chromium type. It has all the desirable properties of such steels—resistance to abrasion, high hardness and excellent non-deforming characteristics. In addition, it is tougher but easier to machine than the higher carbon/high chromium types which are usually oil hardening.

For the finest in tool steel to help solve your cutting, forming, or blanking problems, call your nearest A-L office or distributor today, or write Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.

For complete MODERN Tooling, call Allegheny Ludlum



WHICH OF YOUR METAL-CLEANING JOBS WOULD YOU LIKE TO IMPROVE?

Some good things to know about Metal Cleaning

- ¶ Are you cleaning metal in the most economical way? See page 9 of Oakite's FREE booklet on Metal Cleaning.
- ¶ Are you cleaning metal the fastest way? See page 11.
- ¶ Can you clean brass anodically with no tarnish? See page 18.
- ¶ Can you clean steel and prepare it for painting for less than 20 cents per 1,000 square feet? See page 24.
- ¶ Do you need a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? See page 28.
- ¶ How do you clean parts that are too large to be soaked in tanks or sprayed in machines? See page 30.
- ¶ Does your burnishing barrel produce high luster? See page 32.
- ¶ What do you do when oversprayed paint neither floats nor sinks in your paint spray booth wash water? See page 35.
- ¶ Would you like to eliminate expensive drying from your anti-rust procedure? See page 37.

the operations discussed in this 44-page illustrated booklet. Please check the jobs in which you are interested. Then let us show you how Oakite methods can give you better production with greater economy.

OAKITE PRODUCTS, INC.

SPECIALIZED INDUSTRIAL CLEANING CARANTERIALS - METHODS - SERV	OAKITE PRODUCTS, INC., 20	Rector Street, New York 6, N. Y. Lethods and materials for the force coating Paint stripping Steam-detergent cleaning Barrel cleaning ALSO send me a FREI "Some good things"	ollowing jobs: Burnishing Rust prevention Treating water in paint spray booths Machining and grinding copy of your booklet to know about Metal Cleaning
Technical Service Representatives in Principal Cities of U. S. and Canada	Name		
	Company		(All 100 All 1



Why These Circular Forgings Have So Many Uses

It's become second nature for many manufacturers to call for Bethlehem forged-and-rolled circular forgings. These round forgings are so strong, and machine so beautifully, that they are top choice for many jobs. What's more, they come in sizes from 10 to 42 in. OD, giving them a still broader range of application.

Here are a few of the products being made today from these circular forgings: spur, bevel, herringbone, and other types of gears; double-flange crane-track wheels; industrial wheels of many kinds; turbine rotors and bucket wheels; clutch drums; brake drums; pipe flanges; sheave wheels and fly-

wheels; tire molds and mold rings.

There are of course many others, some highly specialized. For instance, Filer & Stowell, world's largest builder of heavy-duty sawmill machinery, uses these blanks in the making of its carriage wheels. A sawmill carriage is subjected to some mighty heavy burdens, and the strength inherent in Bethlehem circular blanks makes design problems easier. Two kinds of Bethlehem wheel blanks are used at the F & S plant, and one of the finished wheels is shown in the photograph above.

In the making of your own products, there may be ways in which these sturdy forgings can add to the overall strength. If you would like to have additional information, just write for a copy of Booklet 216. It's filled with illustrations, and it contains many ideas that could be of real help to you.

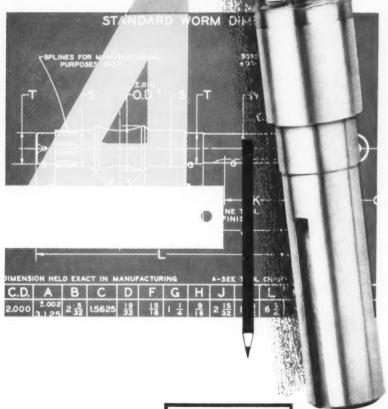
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



free machining MAX-EL alloy steel worm finish machined after full heat treatment...



This double enveloping worm of Crucible MAX-EL® 31/2 alloy steel, made by Cone Drive Gears, Division of Michigan Tool Company, was completely machined after full heat treatment.

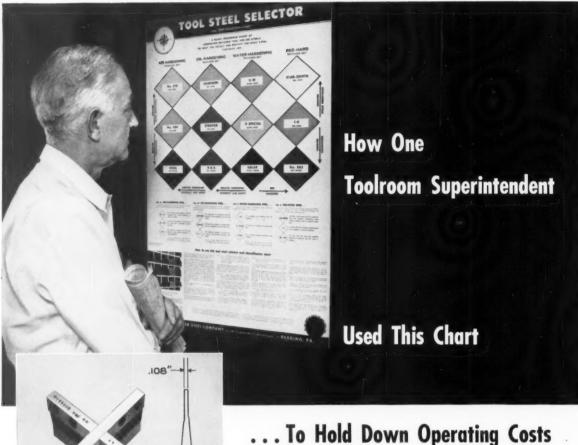
As our customer writes: "This requires an extremely free-cutting material in order to secure desired accuracy, and we have used MAX-EL quite successfully, due to its free machinability in the heat-treated state (Rockwell C 35-38)."

But try MAX-EL for yourself. You'll find that its free machining qualities, freedom from distortion, deep hardening characteristics, and the longer tool life you will get from its use, will help your production line run smoother. For further information, and fast delivery of MAX-EL - call Crucible.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.



Job: A set of three special punches used on a high speed machine to close the joints on prefabricated metal window frames made from 1/8" thick SAE

Problem: Many types and grades of tool steels were tried, but all lacked the necessary toughness and hardening safety. Best service life from any before breakage was three days. Because a set of 3 punches cost hundreds of dollars to make, the low production was hiking up operating costs at a prohibitive rate.

Solution: In a final effort to find a steel with enough toughness and safety in hardening, the Toolroom Superintendent turned to Carpenter and the Matched Set, Method. Carpenter R.D.S. (Oil-Tough) was

Results: Now punches stay in service for about three months, and instead of breaking, they wear out in service

In working with many men responsible for tools and dies, we've discovered a simple but often overlooked fact: The man who approaches each tool and diemaking job with the idea of . . . Simplifying it, Reducing heat treating hazards, and Improving previous performance . . . is bound to do a

If you or your men have that approach, Carpenter wants to be of help. We like to think of our association with customers as a "partnership" in a mutual effort to get best possible results. And here's what we offer: Practical, workable help at every step from diemaking, to heat treating, through on-the-job performance.

And that's why it works . . . both of us have a common goal. Just one example of hundreds is found in the Field Report shown to the left.

One part of this program is the Carpenter Matched Set Method. It is an accurate blueprint for selecting the one die steel ideally suited to give you the results you want. It is all outlined in a convenient, full-color Wall Chart available to you.

And that's only a part of the program . . . a program that involves almost 70 years' experience in the development of new and constantly-improved die steels. We're ready to work for you, now. Simply call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor. THE CARPENTER STEEL Co., 105 W. Bern St., Reading, Pa.



arpenter

Matched Tool and Die Steels

IMMEDIATE DELIVERY from local warehouse stocks

Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"



Wide range of models

NEW BRITAIN +GF+

Changed over in minutes, using simple template, or prototype.

Created specifically for profitable copy turning and boring. Ask your New Britain representative for a showing of the color motion picture "A NEW APPROACH TO COPY TURNING" in your own plant. Or write The New Britain Machine Co., New Britain, Conn.

Economical for short or production runs.

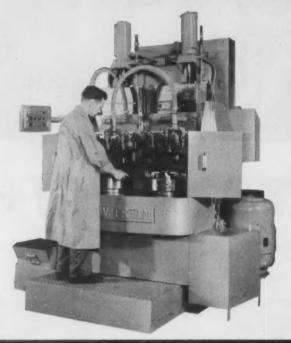
See the following four pages for other New Britain New's.





New Approach to Precision Boring

It's cam actuated • It's vertical • It's New Britain

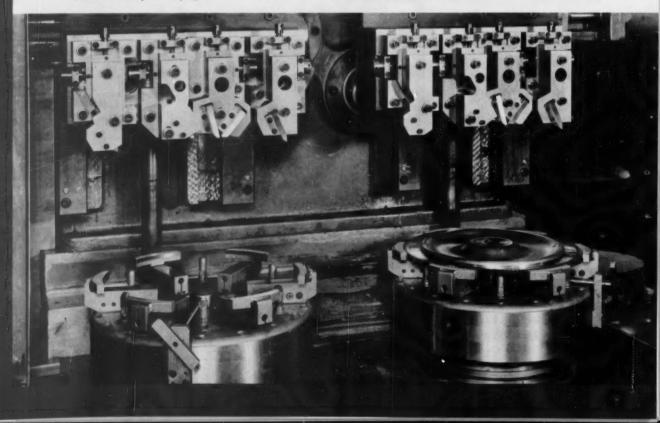


It extends the speed, accuracy and fine finish of precision straight and contour boring and turning to an even wider range of work.

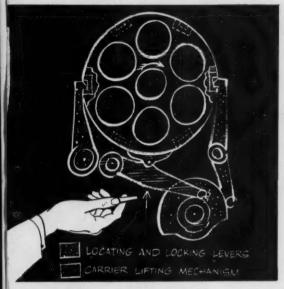
New Britain's new vertical models feature accurate control of tool paths and cycle timing. This is the basic approach to precision boring employed in New Britain's famous single and double-end boring machines.

Shown below: a close-up of the tooling area of the Model 210 New Britain Vertical Precision Boring Machine at the top of the page.

Two pieces are machined simultaneously by duplicate sets of tools. Left hand piece has been removed to show construction of chuck.

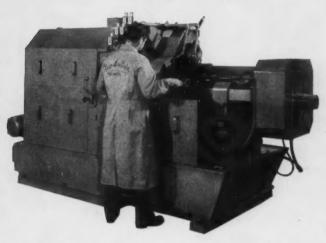






Even slight wear on the spindle carrier or its locating pads would destroy accurate alignment of end-working tools with center line of the spindle. Blackboard sketch shows how carrier is lifted during index, positively located and locked during cutting cycle.

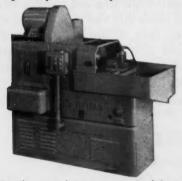
Billions of indexes with absolutely no wear!



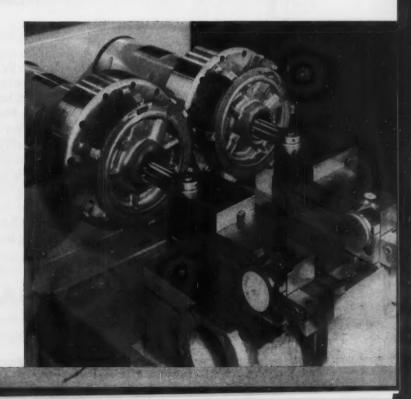
Experienced shop men say: New Britain Chuckers stay on the job and stay accurate. That sums up the profitable end results of exclusive features like the one described at the left.

The secret of precision boring is constant close control of the tool

Successful precision boring and turning calls for control of tool paths and cycle timing, both with "gage makers" accuracy. Precision ground cams insure this accuracy under all conditions on a New Britain. This hairline control, combined with ruggedness and stamina for permanent accuracy, produces fine finishes piece after piece, year in and year out.

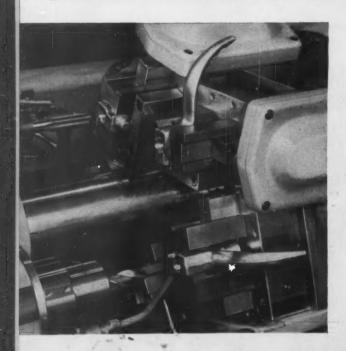


See the preceding two pages and the two following for other New Britain New's.





New New Britain Chucker will produce pieces as fast as operator can load them.



Irregularly shaped pieces — parts difficult to swing on a work-rotating chucker — pieces hard to produce at a profit, belong on the New Britain Model 23B.

This four-spindle chucker can machine up to 1290 pieces per hour (that's one every three seconds). A fifth, easily-operated, quick-acting chuck in the loading position minimizes idle time and operator fatigue.

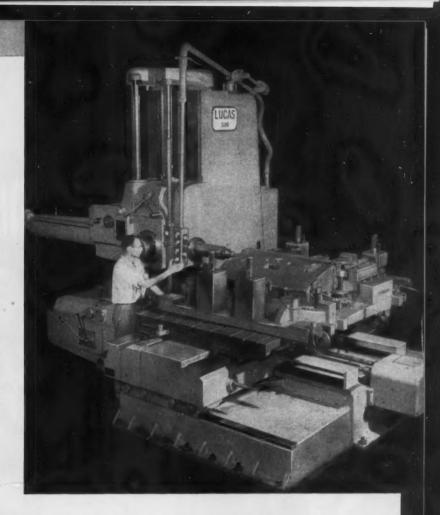
If you produce pieces that lend themselves to a tool rotating machine, New Britain Model 23B could become one of the most valuable machines in your shop. Check with the New Britain man or write for Catalog on Model 23B.



Model 6120S Lucas Precision Horizontal Boring Machine built for a large stamping plant, is used for reconditioning, altering and originating large die sections.

This short bed space-saving machine incorporates all the features of standard machines except a backrest for bar support. The 120" wide bed is of one piece construction for rigid table and saddle support.

This machine is ideally suited to heavy die work which combines operations of boring, drilling and milling in both high and low speeds.



This Lucas will be YEARS AHEAD for a long time

Because Lucas applies its engineering skill to boring machines exclusively—because so many of the important improvements have originated at Lucas—because every new development is incorporated in the next lot built, you get the latest first when you buy a Lucas.

For example: Lucas, one of the first to develop pendant controls on the Horizontal Boring Machine, now offers a new, compact, lightweight control pendant with smooth operating multi-purpose directional switch levers. Or take Lucas Automatic Power Positioning, with built-in, pre-set positioning feed which positively repeats a series of operations without the use of jigs and fixtures. Read more about these features and many other points of Lucas leadership — write for the complete story in detail. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.



AUTOMATIC BAR and CHUCKING MACHINES PRECISION BORING MACHINES
 LUCAS HORIZONTAL BORING, DRILLING and MILLING MACHINES NEW BRITAIN +8F+ COPYING LATHES

The NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut Lucas Machine Division, Cleveland 8, Ohio

See the preceding four pages for other New Britain New's.





STANDARD OIL COMPANY

(Indiana)

Tool Room Superintendent Max Chase (left) and Production Engineer Peter Van Dyke (right) with Standard lubrication specialist R. T. Cleland inspect frame of extruded aluminum. Bob Cleland, a graduate of Michigan State with a B.S. in Mechanical Engineering and of Standard's Sales Engineering School, has the background to provide customers with competent technical service on their lubrication problems. This training and experience, customers have found, pay off for them.

STANOIL Industrial Oil does heavy chores for Light Metals Corporation

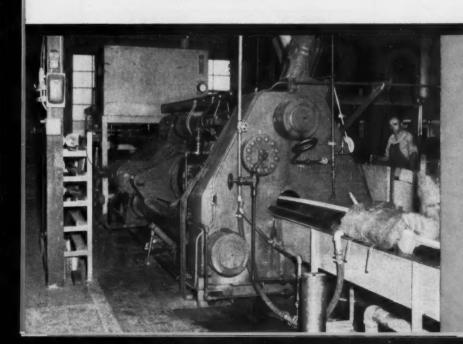
Three years ago Light Metals Corporation, Grand Rapids, put their 1,250 ton Hydropress into operation. The initial fill for the hydraulic system was Stanoil Industrial Oil. The press has operated continuously since its start up. There is no evidence of deposits or varnish anywhere in the hydraulic system. Light Metals Corporation looks forward to many more years of such trouble-free operation.

Why was Stanoil ordered by Light Metals for their Hydropress? The answer is found in the service Stanoil has given in other equipment. Back in 1948 when a Watson-Stillman extrusion press went into operation for Light Metals, Stanoil was chosen as the hydraulic oil. As with the Hydropress, Stanoil has a perfect per-

formance record. The Watson-Stillman press has operated seven years without a shutdown because of hydraulic fluid failure.

This kind of service from a hydraulic oil means Light Metals Corporation can turn out extruded aluminum shapes for the aircraft, automotive and major appliance industries with high performance and low maintenance factors that mean bigger profits. Reason enough for relying on Stanoil.

STANOIL Industrial Oil can perform for you just as it is doing for Light Metals Corporation. In the Midwest a lubrication specialist from your nearby Standard Oil office will explain how. Call him. Or contact, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.



Light Metals Corporation uses this 1,250 ton Hydropress for extrusion of aluminum shapes for aircraft, automotive and major appliance industries. Press operates at 2,840 psi in the hydraulic system. Hydraulic medium is STANOIL.

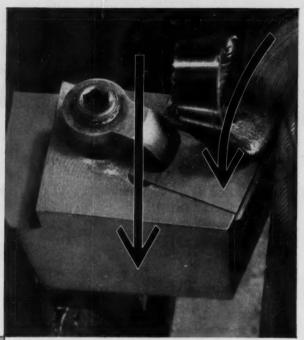
NEW KENDEX TOOLING

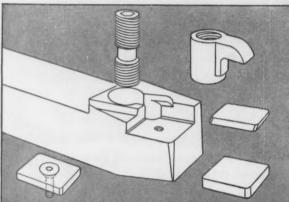
costs less on all 3 counts

... initial cost, tool cost per piece and parts replacement cost

Each component of the *new* Kendex Tooling has been designed with but one thought in mind . . . lowest possible cost per cutting edge.

The holders are of simple but sturdy construction, and have the capacity to take deep cuts in a wide variety of operations. The clamp lifts for quick, accurate indexing, and is so designed that clamp forces are in the same direction as cutting forces—not opposed to them—to avoid counter stresses. Hardened, replaceable shims, on all but





The effectiveness of the rugged Kendex holder can be measured by its capacity to take a variety of cuts, from extra light to very deep, using the same tool.

Clamp forces are in same direction as cutting forces—and not opposed to them. This is indicated by the arrows in the above photograph. Counter stresses are thus eliminated, adding to tool life.

←The new Kendex is simple in design with a minimum of parts... no complex mechanism to adjust or fail. "Throwaway" type inserts index quickly and accurately in the rugged, heat-treated shank, with cutting edge perfectly aligned. Clamp has sufficient travel to hold insert when carbide chip-breaker is not used. Shim (where used) screws to holder.

The table below gives a comparison of initial cost of Kendex holder and hardware with a comparative, competitive tool. Note the low cost of replacement parts for the Kendex KAR 16.

the smallest size, protect shanks in case of accidents with the tools. There is no complicated seat adjustment mechanism to weaken the Kendex shank. Kendex "turnover" inserts fit perfectly into place in accurately ground seats, and are supported by solid, heat-treated shanks. Center height of the cutting point is constantly maintained.

The new Kendex is available in a range of sizes in nine styles and two models: (1) Standard Tool used with or without replaceable chipbreakers, for a wide variety of average operations; (2) Heavy Duty model, with low cost, replaceable chip deflector, for cutting heavy and irregularly shaped forgings or castings where depth of cut may vary as much as one inch from side to side. Both models use "throwaway" inserts . . . eliminate grinding.

To learn how you can cut machining costs on all three counts, call your Kennametal representative, or write to Kennametal Inc., Latrobe, Pa.

TOOL COST COMPARISON

(1" x 1" shank, without inserts)

Holder only\$ 8.00
Hardware: \$0.90 Clamp 1.25 Clamp Screw 0.15
2.30

†Hardened, replaceable shim absorbs stresses of any possible overloading beyond tool capacity. Inserts last longer and machining costs are held to a minimum.

8510

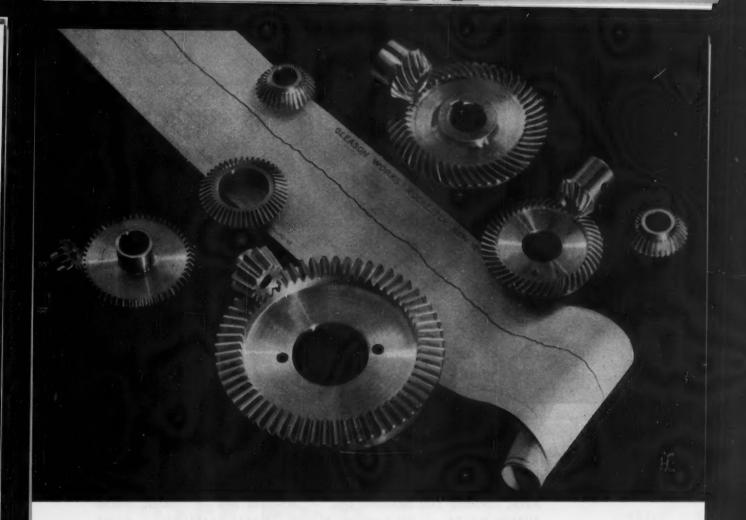




KENNAMETAL
... Partners in Progress



^{*}Registered trademark



For better fine pitch gears ...

Gleason Works now offers complete production and testing facilities for any fine pitch spiral, bevel, hypoid, Zerol® or Coniflex® gears.

Bevel gears produced and tested with Gleason equipment assure the highest degree of accuracy obtainable in angular motion transmission. And, with the new methods and improved design incorporated in these Gleason machines, fine pitch gears can be produced at a lower cost than ever before!

Generators and grinders

Three Gleason Generators cover the entire field of cut fine pitch bevel gears up to $4\frac{1}{2}$ " diameter. These include the No. 2, 103 Straight Bevel Coniflex Gen-

erators, and the No. 2 Hypoid Generator. All three are automatic machines for jobbing or high-speed production and will improve quality besides increasing production.

For the ultimate in durability and accuracy, hardened fine pitch bevel gears are ground in the No. 105 Straight Bevel Coniflex Grinder or the No. 7 Hypoid Grinder. These Grinders are completely automatic wet-type, high-speed machines.

In gear manufacturing, testing is just as important as the actual gear cutting or grinding. One Gleason Tester—the No. 104 Hypoid Tester—checks the running qualities, tooth spacing and concentricity of gears up to 4½" diameter.

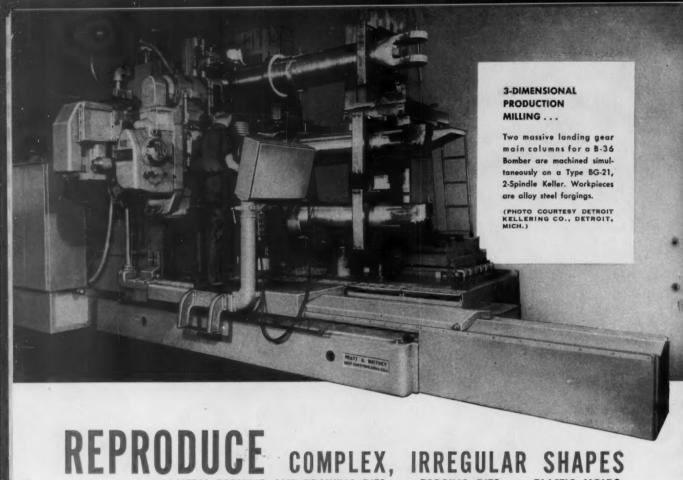
An important new feature of the No. 104 is the provision for recording the rolling test on paper, giving a permanent record of the total composite error. An electronic pickup head for a recorder is furnished, and the recorder itself may be engaged or disengaged, as required.

Engineering services available

Cutter sharpeners and complete tooling are available to suit your requirements. In addition, the services of the Gleason Engineering Department are at your disposal, at no obligation to determine the best fine pitch gears for your application and the machinery required to produce them. Write for further information.



1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.



METAL FORMING AND DRAWING DIES . FORGING DIES . PLASTIC MOLDS
RUBBER MOLDS . DIE CASTING DIES . METAL PATTERNS . CAMS

PROTOTYPE WORK . PRODUCTION MILLING . AND MANY OTHER JOBS

faster and more economically



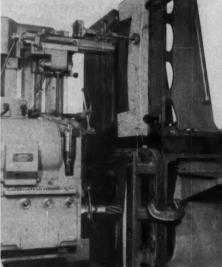
ODERNI

WHITHEY

DIE CASTING DIE . . .

to produce metal shrouds for 25 hp outboard motors. Cavity was deep, intricate, and involved heavy metal removal. Cavity was completely Kellered in only 219 hours on a BG-21 Keller.

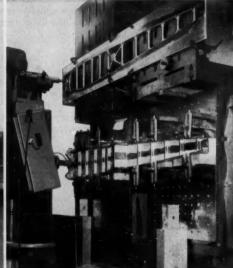
(PHOTO COURTESY ATOLS TOOL AND MOLD CORPORATION, CHICAGO, ILLINOIS)



DRAW DIE . . .

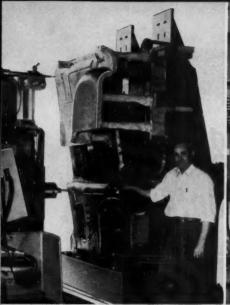
for a motor truck cab door, approximately 48" x 70". The complete job was produced quickly and economically on a Pratt & Whitney Type 8G-21 Keller Machine.

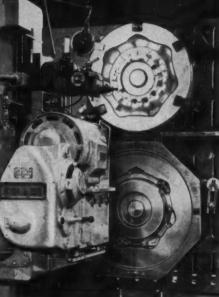
(PHOTO COURTESY BUFFALO TOOL & DIE MFG. CO., BUFFALO, N.Y.)

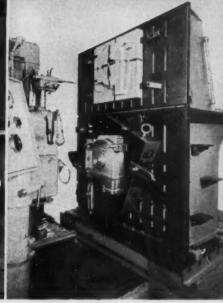


PROFILE MILLING . . .

an aluminum aircraft wing spar is fast and easy with "Kellering." The only template usually required for this type of work is a simple, 2dimensional template.







BODY FORMING DIE ...

machined by full 3-dimensional tracer-controlled milling from an intricate plaster model. The finished die will be used to form a complete section for the famous Fisher Bodies.

(PHOTO COURTESY SONITH PATTERN WORKS, INDIANAPOLIS, IND.)

FORGING DIE . . .

Using a cement master cast from a wooden pattern, the Keller BG-21 duplicates the complex cavity in an aircraft engine forging die. "Kellering" accuracy on this type of work greatly reduces hand finishing cost.

IMPRESSION DIE . . .

18" x 24" x 4" to produce covers for an 18" rotary lawn mower (trade name "Lawn Boy"). Working from a plaster model, a Type BG-21 Keller Machine does the job rapidly, accurately.

(PHOTO COURTESY JOHNSON MOTORS DIV., OUT-DOOR MARINE & MFG. CO., WAUKEEGAN, ILL.)

PRATT & WHITNEY KELLER TYPE BG-21 Automatic Tracer-Controlled Milling MACHINES

OBTAINABLE IN CAPACITIES FROM: 4 FT. HORIZONTAL X 21/2 FT. VERTICAL . . . UP TO 10 FT. HORIZONTAL X 4 FT. VERTICAL.

P&W KELLER Machines are powerful, horizontal spindle milling machines with electric tracer control. They reproduce the shape of any 2-dimensional template or 3-dimensional model accurately and economically; total machining time is much less than that required by other methods. Complicated shapes are duplicated as easily and efficiently as simple ones. The initial job is done more economically, and additional duplicates are produced at a fraction of the usual cost and time.

Keller Machines are designed and built specifically for tracer-controlled milling . . . not just "adapted" . . . and can take on a wide variety of jobs

without requiring major adaptation by costly attachments. They are rugged machines that will operate dependably and accurately year after year without expensive maintenance.

IN ADDITION TO THE NEW TYPE BG-21, LARGER AND SMALLER SIZES OF KELLER MACHINES CAN BE FURNISHED.

WRITE NOW FOR COMPLETE INFORMATION

See how P&W Keller Machines can help reduce machining time and costs and increase your profits. Fill in the attached coupon and mail for your free copy of Circular No. 565 that completely describes the versatile new Type BG-21 Keller.



PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

WEST HARTFORD 1, CONNECTICUT, U. S. A.

SINCE 1860

First Choice (1) for Accuracy

BRANCH OFFICES . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

MACHINE TOOLS . CUTTING TOOLS . GAGES

PRATT & WHITNEY Division Niles-Bement-Pond Co.
12 Charter Oak Blvd., West Hartford 1, Conn.

PLEASE SEND MY FREE COPY OF CIRCULAR NO. 565.

NAME____

POSITION

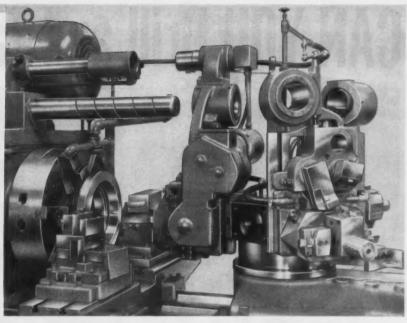
COMPANY

CO. ADDRESS_____

CITY_____ZONE____STATE____







FORTY HORSES "pulled the team" that made this bevel gear blank

ROUGH TURN BACK ANGLE ROUGH TURN and FINISH MACHINE FACE ANGLE ROUGH OND FINISH BORE FACE and FINISH BOTTOM MACHINE 30° BEVEL CHAMFER CORNERS FORM RADII CHAMFER CORNERS -3.037"

The Powerful 6DREL-40 Automatic Turret Lathe -- and P&J Tooling

Machining a forged-steel truck bevel gear blank — 14 distinct cuts with tungsten carbide tools in just 5.88 minutes (including chucking time) — takes a team with plenty of horses to pull it . . . A TEAM LIKE THE P & J 6DREL-40 AUTOMATIC (NOW WITH 40 HORSEPOWER), PLUS JOB-ENGINEERED P & J TOOLING. Here's the team to choose for doing your tough jobs faster . . . and at a lower per-unit cost!

If you're looking for real productive power, it will pay you to look at the 6DRE-40 and 6DRE-40 Automatic Turret Lathes. Write for informative booklet describing these Automatics. Ask for Bulletin No. 128 . . . or ask the P & J Tooling Engineer to submit recommendations based on your sample parts or prints.



POTTER & JOHNSTON CO.

PAWTUCKET, RHODE ISLAND SUBSIDIARY OF

PRATT & WHITNEY

DIVISION NILES - BEMENT - POND COMPANY



OR MORE THAN PIPTY TEARS

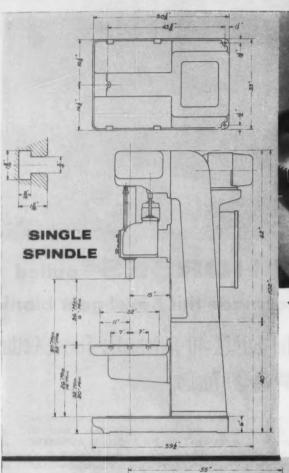
WRITE DIRECT OR CONTACT YOUR MEANEST

BIRMINGHAM BOSTON CHICAGO CINCINNATI CLEVELAND DETROI LOS ANGELES NEW YORK F FHILADELPHIA PITTSBUZGH ROCHESTER SAN FRANCISCO ST. LOUIS

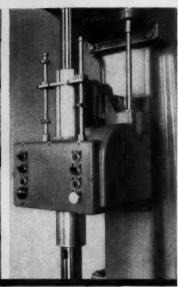
EXPORT DEPT., PAWTUCKET, R.

AGENTS: DALLAS, THE STANCO CO.

CAN YOU Drill and Tap Holes





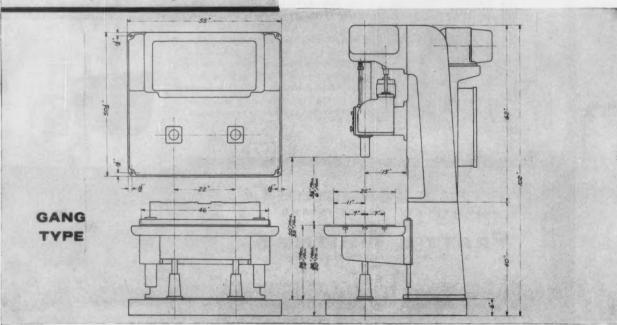


Speeds, Feeds & Tap Leads

A limited number of actually quick change pick-off gears give an unusual combination of speeds and feeds. Geared tap leads are available to cover a wide practical range of tapping operations.

Cycle Control

A simple, rapidly set dog system controls the automatic cycle through limit switches. Terminal block wiring permits extending push-button controls to the most efficient location for unusual jobs.



at the Touch of a Button?

Are your drilling machines universal?

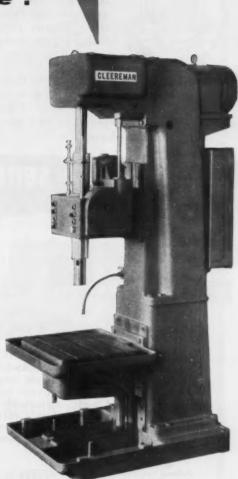
Can you change set-ups in minutes?

Does your equipment set the production pace?

Yes! If you are equipped with Cleereman Series "A" Drilling and Tapping Machines. All these desirable qualities and more, are inherent features in this sound and simple design.

Even if you have short run jobs, you will find the Cleereman Series "A" practical. On long production runs the potential operating efficiency is amazing.

Possible variations, available accessories and special arrangements lend a versatility not found in other designs. Consult your Cleereman distributor . . . he has the answer to your questions.

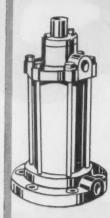




Affillated with

CLEEREMAN MACHINE TOOL CO., Green Bay, Wis. Builders of precision jig Borers and Drilling Machines

I OGAM HYDRAULIC CYLINDERS

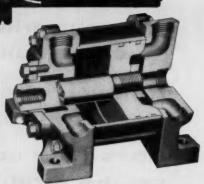


750 SERIES NONROTATING TYPE 7 STANDARD MOUNTINGS

Eight standard sizes from 2" to 8" diameter bore. Maximum operating pressure 750 psi.

Covers chrome nickel cast iron. Large outlet and inlet for rapid action. Bronze packing glands. Steel packing gland caps. Hydraulic-type V-ring packing. Honed, seamless steel tube. Step cut-type piston rings. Piston chrome nickel cast iron. Multiple pipe connections for convenient installation.

Logan 750 Series and Rotating Hydraulic Cylinders are the result of nearly forty years' experience in the development and manufacture of hydraulic equipment. They are today providing high operating efficiency in thousands of plants.

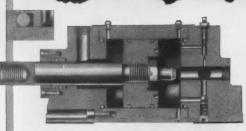


Check the many outstanding features of the Logan hydraulic double-acting, nonrotatingtype cylinder as indicated in the above cross-section. They assure continuous service under most severe operating conditions.

ROTATING "HR" TYPE

Seven standard sizes from 3" to 14" diameter bore. Maximum operating pressure 500 psi.

ROTOCAST SERIES ... 7 STANDARD MOUNTINGS



Sizes from 2" to 8" bore; any length stroke up to 8 feet as standard. Four piston rod end types. Operating pressures to 1500 psi.

Note features as shown in crosssection. Ground and polished alloy steel piston rod. Bronze packing gland bushing. Self-adjusting hydraulic packing. Synthetic

seal rings (see enlargement). Close-fitting pilot for centering piston on piston ring. Nut securely locked to prevent loosening of piston. Close-grained cast piston of ample length to provide necessary bearing and strength. Cushion check valve of ample size to prevent quick start of piston travel. Optional ports. Adjustable cushion speed valve. Automotive-type piston rings. Air vent valves. Centrifugally cast iron cylinder tube retains smooth, accurate bore. Large ports for unrestricted oil flow. There are no hydraulic cylinders more dependable than Logan Rotocast.



Let Logan engineers help you design your Air and Hydraulic Circuits.

MEMBER— National Tool Builders Assn., National Fluid Power Assn.

LOGAN MANUFACTURES 7023 STANDARD CATALOGED ITEMS

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3

AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4

HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 42

LOGANSPORT MACHINE CO., INC., 810 CENTER AVE., LOGANSPORT, IND.

THE
LITTLE
GIANT
OF THE
PETERMANN
FAMILY





For work within its capacity (pieces $\frac{5}{32}$ " in diameter and $1\frac{1}{2}$ " long) we offer a machine of 'deadly' accuracy and high production . . . 10 speeds to 12,000 RPM.

ANOTHER NOTEWORTHY ADVANTAGE

2 HORIZONTAL UNDERCUTTING TOOLS
2 VERTICAL INCLINED ANGLE TOOLS
4 NORMAL TOOLS

8 Tools IN ALL . . . the special toolholders readily replaceable with standard holders or attachments.

JUST ONE MORE REASON WHY PETERMANN IS PREFERRED!



8 X SIZE

BUSSELL, BOLBROOK & BEINDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

The Big Trend in Metalworking...

MOVE the metal ... it's cheaper than

HOW NEW METHODS SAVE BIG SUMS

A. Parts are produced primarily by forcing metal into the desired shape rather than by "removing" or "machining" it. It is far faster . . . saves tremendously in time and labor.

B. The amount of metal in the initial slug, shot, billet, sheet, etc., is only slightly more than the total amount in the finished piece. Thus scrap and machining are held to an absolute minimum.

Metalworking plants casting about for ways to reduce production costs are turning more and more to the newer methods of forging, drawing and extruding in which metal is being "pushed around" rather than "removed." These processes basically are the hot extrusion of alloy steel, cold "pressure" forging of aluminum, cold extrusion of steel, and high pressure closed die extruding of aluminum and other non-ferrous alloys. Also falling within this category



Closed die extruding of heated aluminum reduced production time 99%.



Cold steel extrusion reduced scrap 43%.



Hot alloy steel extrusion is now an established art.



Metal powder parts are often produced with no machining.

- •New and improved production techniques save millions...arouse widespread interest
- Actual parts production is cut from hours in typical . cases to minutes or even seconds.
- Pieces generally have superior finish and improved physicals including grain structure.
- 3. Tolerances and uniformity equal or better those of older methods.
- 4. Scrap is greatly reduced and in many cases practically eliminated.
- 5 Unit costs go way down.

REMOVINGit!

are somewhat older though greatly changed and improved methods for the extrusion of aluminum, hot forging of ferrous metals, powder metallurgy, deep drawing of sheet and die casting. The most recent developments involve variations and combinations of the above applied to many products and materials. Our engineers are in close daily contact with these developments. They'll be glad to help apply any of them to your production. Call or write us.



LAKE ERIE ENGINEERING CORP.

General Offices and Plant:

470 Woodward Avenue, Buffalo 17, N. Y.

District Offices in New York • Chicago • Detroit • Pittsburgh
Representatives in Other U. S. Cities and Foreign Countries

HYDRAULIC PRESSES • DIE CASTING MACHINES ROLLING MILL AUXILIARY EQUIPMENT



New developments in steel forging have greatly expanded its application.



Non-ferrous extrusion installations now embrace titanium. magnesium and newer metals.



Production rates of die cast aluminum and zinc parts have been upped 20% to 30%.

PACKAGED INSTALLATIONS

A new service by Lake Erie which enables you to order an integrated installation .. including production equipment, tooling auxiliary equipment and advisory service ...from a single source thereby saving time, money and trouble.





LEES-BRADNER

Proudly announces the latest developments in the model 7 type HD high speed production hobbing machine

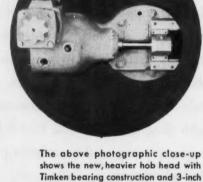
Just as given species improve, giving way to the constant press of nature, so do machines change and improve with the everincreasing demands of industry.

The Lees-Bradner 7 HD Single Spindle Hobber is a good example. It has moved forward in engineering and design improvements to meet today's and tomorrow's production demands.

Pioneers in high speed hobbing, The Lees-Bradner Company has, through constant experimentation, created a hobbing machine far superior to its prototype. The new Model 7 Type HD Single Spindle Hobbing Machine offers industry a heavier and faster machine. Weighing approximately 1,000 lbs. more than its predecessor, it has a heavier headstock, heavier column, 10 H. P. motor and 2 H. P. rapid traverse motor.

Designed-in improvements such as these give industry savings in time and labor while meeting today's production demands ... plus the extra capacity for tomorrow's requirements.

Demonstrations may be arranged on request. Contact your Lees-Bradner representative, or write us direct. No obligation, of course.

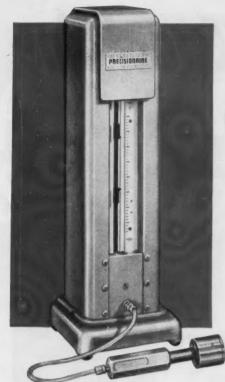


Timken bearing construction and 3-inch hob shift and new outer support.

LEES-BRADNER

128-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257



A CHANGE IN WORK PART TOLERANCE

Doesn't Obsolete

YOUR PRECISIONAIRE

Immediate conversion to meet an engineering change, a shift from one part to another or a change in tolerance or processing —is an unequalled and exclusive advantage of Precisionaire Column Instruments.

For instance, should the .0005 tolerance of parts being checked with a 10,000 or 5,000 Column Instrument, be changed to .002, a new instrument is not required. Merely change over the Precisionaire with a 1,000 or 2,000 Conversion Kit in less than three minutes.

The Precisionaire Column Instrument is always usable this minute, an hour, a week, a month or a year from now, with any appropriate gaging elements, regardless of shifting tolerances, changes in processing and engineering and changeover from one part to another.

NO OTHER AIR GAGE HAS THIS IMMEDIATE FLEXI-BILITY—Precisionaire Column Instruments are always usable. They are the most universal in use—and the most universally used.

Learn more about the spectacular versatility and economy of Precisionaires—call your Sheffield Representative or phone, wire or write Dayton for a showing of automatic sound slide films on air gaging—they can be shown on your desk.



the ONE COMPLETE Tool Line



You Can't Afford to Miss at the A. S. T. E. Western Industrial Exposition

Yes, for the best answer to every tooling need, Davis is the one line you'll want to inspect with care. It offers you unrestricted selection from the broadest standard line of boring, turning and planing tools . . . plus the most advanced and efficient special-engineered tooling designs produced in the industry.

DAVIS

BORING TOOL DIVISION .

Giddings & Lewis Machine Tool Company Fond do Lac, Wisconsin

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING

for face Surface Surface accuracy SIMONDS ABRASIVE CO. ROLL GRINDING WHEELS

For the right finish start with Simonds Roll Grinding Wheels. Fast, cool, free cutting action. Used for regrinding and refinishing everything from giant back-up and work rolls to small jewelers rolls. Borolon (aluminum oxide abrasive) for steel and alloy steel rolls. Electrolon (silicon carbide) for chilled iron, cast iron, brass, copper and non-metallic rolls. Write for free bulletin ESA 237 "Roll Grinding Wheels for Surface Accuracy"

SIMONDS ABRASIVE COMPANY . PHILADELPHIA 37, PA.

Branch Warehouses: Boston, Detroit, Chicago, Portland, San Francisco • Distributors in Principal Cities

Division of Simonds Saw and Steel Co., Fitchburg, Mass. • Other Simonds Companies: Simonds Steel Mills, Lockport, N.Y.,

Simonds Canada Saw Co., Ltd., Montreal, Quebec, Lion Grinding Wheels Div., Brockville, Ont. and

Simonds Canada Abrasive Co., Ltd., Arvida, Quebec





"Threads tore
when they tapped
B-III7 steel pipe
...here's why"



During a recent visit to a large midwestern manufacturer of refrigeration and heat transfer equipment, Sinclair Industrial Representative R. L. Hart found the concern experiencing unusual difficulty in tapping a B-1117 steel pipe.

Oil not following tap

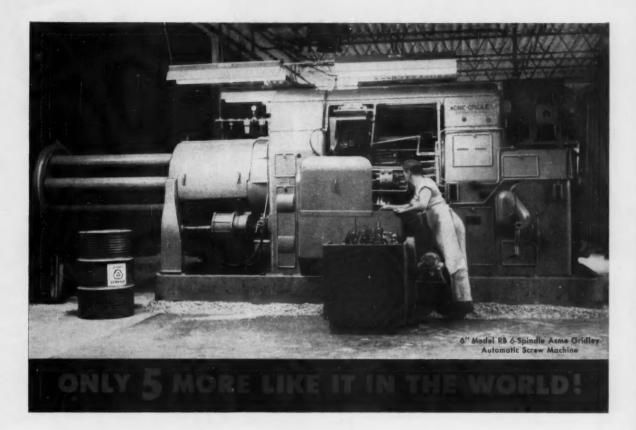
Mr. Hart reports, "The work was being done on a hand screw machine with competitive cutting fluid. Closer inspection showed that the oil was not following the tap but was wiping off at the point of insertion—leaving a rough, torn thread."

Needed lightness, lard and sulphur

Mr. Hart continues, "Basing my recommendation on previous experience, I suggested Sinclair AUTOKUT® C. This oil would be light enough to follow the tap—with enough lard and sulphur to perform the cutting job. The manufacturer agreed to switch. In two weeks time he reported the trouble had completely vanished—thread quality far exceeded his expectations."

Why not let a Sinclair Lubrication Engineer help solve your cutting oil problems. There's no obligation. Contact your local Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR LUBRICANTS



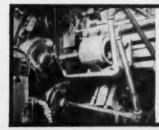
Owned by Jessen Manufacturing Company, today's most advanced automatic screw machine uses Cities Service Cutting and Hydraulic Oil

Weighing 39 tons and powered by a 60 H.P. motor, this 6-inch, 6-spindle Acme Gridley Automatic Screw Machine is one of the only six now in existence . . . and the only one owned by a job shop. Featuring a combination pneumatic-hydraulic operation, it can turn out a single load of stock weighing 3 tons!

The owner is Jessen Manufacturing Company of Elkhart, Indiana—since 1923 famous for keeping on top of new developments. It's not strange, therefore, that for this advanced new machine they chose a top quality coolant—a Cities Service cutting fluid.

Says President J. H. Jessen: "We're happy to say that the Cities Service cutting oil we use today is one of the finest all-around cutting oils we have ever used. In years past, we felt that if a cutting oil was good, it had to be black, heavy, and odorous. Cities Service has changed our minds with a cutting oil that has outstanding cooling abilities, good chip drain-off, is anti-weld... and yet possesses light, clear color and has no noticeable odor. In addition, Cities Service Pacemaker Oil used in hydraulic systems, and Amplex Lubricating Oil are doing an outstanding job throughout our shop. We proudly recommend all these Cities Service Oils."

For more information on the complete line of Cities Service cutting fluids, call in a Cities Service Lubrication Engineer. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



Light, Clear Coolant in Acme-Gridley Automatic is Cities Service cutting oil. "Outstanding cooling, anti-weld, and chip drain-off ability," says Jessen. Firm also praises Pacemaker Oils, used in their hydraulic operations.



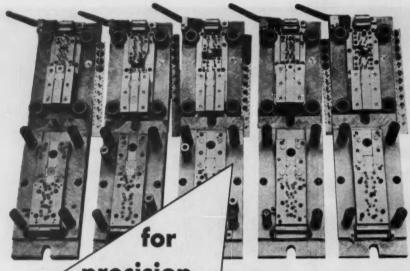
Jessen Mfg. Company., Inc. Mr. Jacob Jessen, Pres., in business since 1923, has earned reputation of keeping on top of new developments. In 1935, he was one of the first to install 6-spindle, anti-friction bearing screw machine.

CITIES (SERVICE

QUALITY PETROLEUM PRODUCTS

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955--133



precision jobs like this.

jobs like this.... Moore Jig Borers and Jig Grinders are "MADE TO ORDER"



NO. 2 MOORE JIG BORER. Range 10" x 16" x 16" height. Features infinitely variable spindle speeds, three power feed ratios, centralized controls.



NO. 2 MOORE JIG GRINDER. Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up or down; spindle-housing heat control; features slot grinding attachment. Moore Jig Borers and Jig Grinders are made to order for jobs that require precision hole location—and plenty of it.

Take, for example, these five progressive compound dies used to pierce, shave, gut and blank intricate timing-device parts.

Holes in punch plate and stripper were jig bored in a No. 2 Moore Jig Borer. Holes in the corresponding die parts were jig bored in the same precision machine, hardened and then jig ground in a No. 2 Moore Jig Grinder. Perfect line-up was insured, since all holes had to be held to ± .0002", both for position and hole size.

The No. 2 Moore Jig Borer, with its built-in system of accurate lead screws, can spot, drill, bore or ream all holes in a workpiece to "tenths" with minimum tool changes. The No. 2 Moore Jig Grinder can accurately contour grind, slot grind and form grind die sections in a third of the time required by other means.

These Moore toolroom teammates provide a one-two punch that can knock the fat off your diemaking costs. They supply an Engineered Hole Location Service that permits tool and die sections to be produced concurrently...puts diemaking on an interchangeable-parts-and-assembly basis...lengthens die life...saves you time and money all along the line.

Write today for our detailed literature that pictures and describes many toolroom and production jobs for which Moore Jig Borers and Jig Grinders are made to order.

MOORE SPECIAL TOOL COMPANY, INC.
734 Union Ave., Bridgeport 7, Conn.

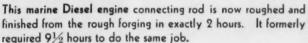
ADD (TAGES) TO YOUR TOOLROOM

JIG BORERS - JIG GRINDERS - PANTO-CRUSH WHEEL DRESSERS - DIE FLIPPERS - MOTORIZED CENTERS - HOLE LOCATION ACCESSORIES

134-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257



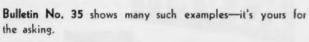


With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

More production per man hour is the answer and the only answer to prohibitive costs-modern, high production machinery is the answer to greater production per man hour.

The astounding saving on this connecting rod job is the result of transferring it from previous equipment to a new 32-inch "AMERICAN" Hydraulic Duplicating Lathe. Such savings as this are not the exception but the rule when "AMERICAN" Duplicators are put on the job.

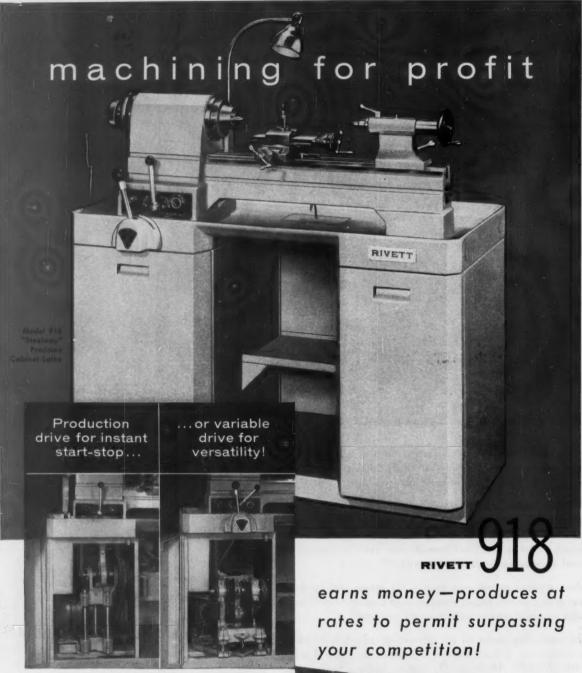
the asking.



THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio U.S.A.

Lathes and Radial Drills



Use a modern lathe—consistent in size with the work to be done. Gain advantage of time-saving features—to reduce operator effort, lessen time between set-ups, permit a faster rate of production!

The Rivett 918 offers this opportunity. Many shops are taking advantage of it. Why don't you?

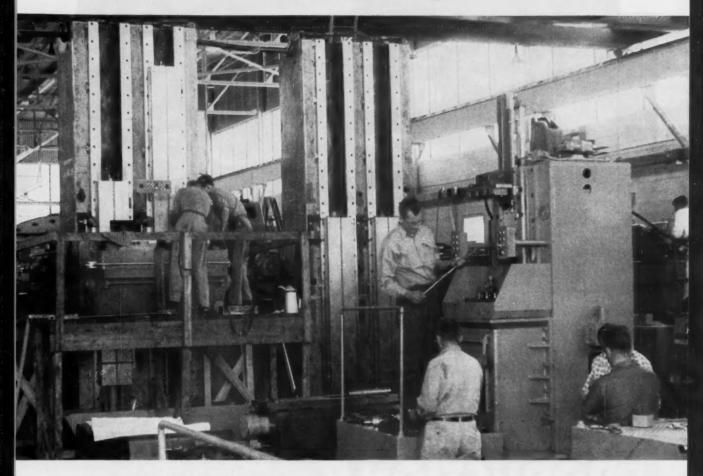
RIVETT

Write for Bulletin 918-SLB and see→



RIVETT LATHE & GRINDER, INC.—DEPT. MR-3, BRIGHTON 35, BOSTON, MASS.

Years of Broaching Experience



Now Applied to Building THE FINEST IN BROACHING MACHINES

Detroit Broach is in the machine tool business!

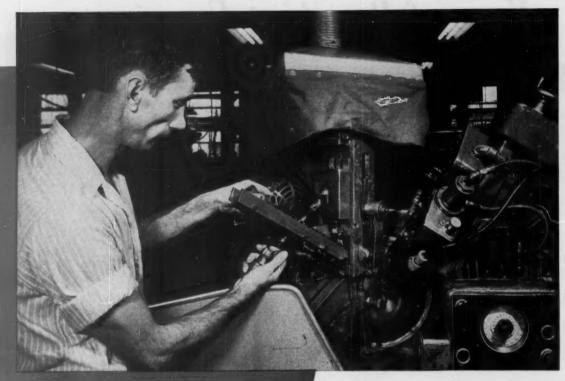
It was a logical step for Detroit Broach to move into this activity. Here is a company that is known throughout the world as a pioneer and leader in the design and manufacture of broach tooling. The engineering abilities that have built this reputation, and the knowledge gained through the application of the tooling to machines of every make and model, are reflected in these new machines which are already demonstrating exceptional production efficiency in broaching. Incorporating proven features—such as Oilgear hydraulic equipment—with many advanced design ideas, they are establishing new standards in the broaching machine field.

Today, Detroit Broach offers you the "complete package" in broaching . . . from a single broach to a completely tooled machine . . . produced to meet *exactly* every requirement for accurate, trouble-free performance.

WHATEVER YOU
NEED IN BROACHING
DETROIT BROACH
CAN SUPPLY IT

Detroit Broach COMPANY

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD



HOW BETTER LUBRICATION INCREASED PRODUCTION

for Tyson Bearing Corporation, Massillon, Ohio

THE JOB is grinding O. D. of bearing cones. Four micro-centric grinders are used.

BEFORE TEXACO was used, the sleeve bearings in the grinding and work spindles lasted only about

three weeks, and production was off due to excessive machine downtime. Cause of bearing failure was contamination of spindle lubricant by the grinding oil, resulting in ineffective lubrication.

AFTER TEXACO Cleartex Oil was installed—to be used as both grinding oil and machine lubricant—the improved lubrication eliminated bearing failures. There hasn't been one now for over a year! And with Texaco Cleartex Oil, Tyson can get as many as twenty pieces (with better finish) per wheel dressing—as against the ten or twelve previously obtained.

These benefits are typical wherever Texaco takes over. There is a complete line of Texaco Cutting, Grinding and Soluble Oils to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly help you select the right ones for your jobs.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO

CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

TUNE IN: TEXACO STAR THEATER starring DONALD O'CONNOR or JIMMY DURANTE, on TV Sat. nights. METROPOLITAN OPERA radio broadcasts Sat. afternoons.

138-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257



By LORING F. OVERMAN

New Legislative Proposals Require Close Scrutiny

IF the Eighty-fourth Congress adjourns by its target date of next July 4, the prospect is that only "must" legislation will be comlegislation will be completed. Understandably, each side of the political aisle will have its own idea of what to consider essential. Administration proposals, contained in the President's messages to Congress, concerning taxes, defense, extension of the Small Business Administration, and appropriations measures, probably will be passed with reasonable promptness. However, it is obvious that much new business of general interest will be left stranded by the expected short

Ironically, the likelihood that action on such items will be postponed is reason to believe that the number of new legislative proposals will be greatly increased. Hundreds of proposals that are conceded little chance of passage are being dropped into the legislative hopper as trial balloons; either to test the mettle of the opposition, or to give the author credit among his constituents for a good try at a time when failure of passage can be readily blamed on the opposition party. The danger of such a situation is that ill-conceived legislation, which on the surface appears to be neither significant nor controversial, may unwittingly slip through unless it is closely watched. Thus, it is highly important for members of the machinery and metal-working industries to keep their senators and congressmen informed of their requirements and wishes, which could be done either individually, or in concert through their trade associations.

Machinery Production Outlook

Barring serious repercussions of the Formosa situation, the outlook for machinery for defense production promises to be about the same in fiscal 1956 as in 1955. The President's budget message observed: "Expenditures for procurement and production of major items of equipment will continue at approximately the same level as during the current fiscal year, and will constitute more than one-third of the total projected expenditures of the Department of Defense." The President went on to say that aircraft and guided missiles will account for two-thirds of the outlay for major procurement, and that ship-building expenditures will be increased.

To assist in coordinating the programs concerned with eliminating critical shortages in military components, and to review the machine tool picture, the Office of Defense Mobilization has named a new Advisory Committee on Components and Production Equipment. Duties of the committee, headed by Harold S. Vance, are outlined in ODM General Administrative Order VII-2. Mr. Vance also served as head of the earlier ODM Committee on Production Equipment, and originated the "Vance Plan" for keeping the defense plant facilities modern, in anticipation of emergency requirements. Only a small part of Mr. Vance's plan has been put into effect to date.

Consequently, the new ODM order authorizes the committee to "review federal policies and programs with respect to machine tools and production equipment, and to make recommendations to the Director of the Office of Defense Mobilization concerning the establishment of such policies and programs as may be needed to assure (a) the availability of machine tools and production equipment to meet defense production requirements; (b) the maintenance of adequate capacity to produce machine tools and production equipment as part of the mobilization base; and (c) the maintenance of stand-by machine tools and production equipment-including methods of modernization, rotation, or disposition of obsolete tool and production equipment-to meet mobilization requirements."

Economic Report Optimistic

With machinery purchases for war production expected to level off somewhat, what of the outlook in private industry? In his annual "Economic Report to Congress," the President observed, "The recent high level of commercial building contracts is practically sure to mean a high level of expenditure for this type of construction over the coming months. The prospects for plant and equipment expenditures are more uncertain; however, rising orders for machinery, to say nothing of the new plans and revisions of

old plans that are likely to accompany continued business recovery, give basis for expecting that this broad category of expenditures will soon join, though perhaps only modestly at the start, the general economic advance.

"In the course of the current year, the economic situation may, therefore, be expected to continue to improve. The gross national production increased from an annual rate of about \$355,000,000,000,000 in the third quarter of 1954 to about \$360,000,000,000 in the fourth quarter." Growth of national production to \$500,000,000,000 within ten years was forecast by the President.

Washington Briefs

Measuring Cutting-Tool Wear-Radioisotopes have been used by the United States arsenal at Rock Island, Ill., to measure the rate of cutting-tool wear. The arsenal experimented with tools irradiated at the Oak Ridge National Laboratory. Radioactivity transferred from the tools to the resulting chips was the basis for measuring relative tool life. Results of the test are covered in the arsenal's research report, "Machining Studies by Radiometric Methods." Illustrations, graphs, and tables are included. Copies of the report (PB 111473) can be obtained for 75 cents each from the Office of Technical Services, Room 6227, Commerce Department, Washington 25, D. C.

Rental Charges Boosted-Defense Department Instruction No. 4215.2, released January 18th, prescribes increased rental charges for government-owned machine tools leased to private contractors. The instruction, signed by Thomas P. Pike, Assistant Defense Secretary for Supply and Logistics, provides in general for a monthly rental of 2 per cent of acquisition costs for machines built in 1950 and later; 1.5 per cent per month for machines built between 1942 and 1949; and 1 per cent per month for machines built prior to 1942. These rates are subject to negotiation when leases cover entire government-owned plants, or involve substantial governmentowned real estate, or when leases include the maintenance of a mobilization base.

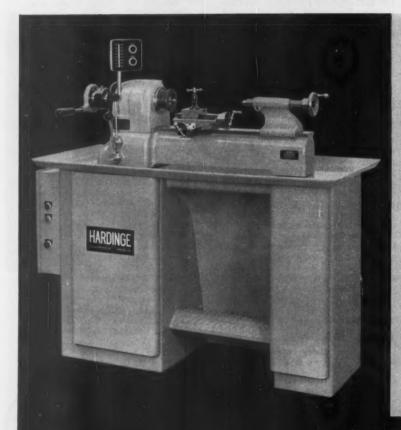


INGE NEW Lathe with Variable Speed for Tool Room—Development—Production Work



Simply Push a Button for Exact Spindle Speeds

It's the NEW Simplified Design EASY AND CONVENIENT TO OPERATE



FEATURING:

- Infinitely Variable
 Speeds 230 to 3500 r.p.m.
- Fast Lever Operated Collet with 11/6" Capacity
- Hardened and Ground Steel Dovetail Bed Ways
- Patented Positive Lock
 Slide Rest
- Full Bearing Tailstock
- And Other Cost Cutting Features

For Complete Information on this Precision Lathe Write for Bulletin DV59

HARDINGE BROTHERS, INC., ELMIRA, N.Y.

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

Will Automation Lessen the Need for Labor?

ELECTRIC mixers, toasters, refrigerators, vacuum cleaners, and other appliances that are considered household necessities have not taken the woman out of the kitchen. Power lawnmowers and electric hedge clippers have not taken the man out of the garden. These modern home appliances have merely removed drudgery from daily chores and increased leisure around the home. They have not reduced the amount of work to be done.

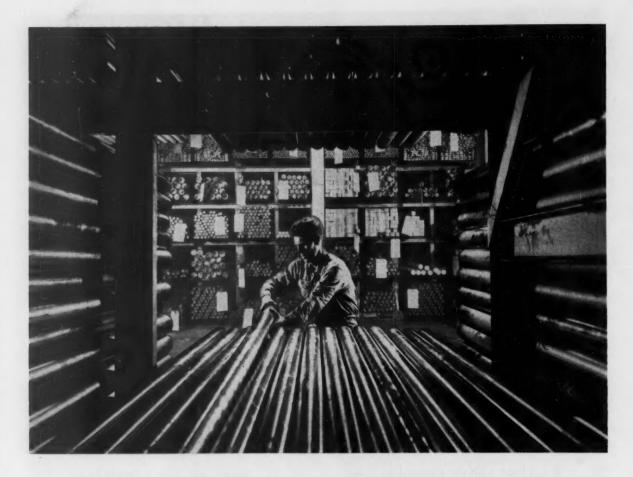
So it has been with the tremendous development in automatic factory equipment since the days of the Industrial Revolution. Back in 1791, mobs burned down the English factory that was equipped with the early Arkwright weaving looms because they felt that the looms would throw people out of work. Instead, the loom made the vast textile industry possible and created thousands of jobs in the field of merchandising and advertising that were previously non-existent.

Automatic equipment in various industries enabled working hours to be reduced from as high as twelve hours per day to the universal standard of eight hours. In time, the increased production created many more jobs because it enabled commodities to be manufactured at costs within the means of a much higher proportion of the population. Where would the automobile industry be today if it were not for the automatic machinery that enables the sale of over 6,000,000 cars annually in the United States alone! In addition to the hundreds of thousands of workmen engaged by the companies that manufacture the cars, there are several million persons involved in selling the cars, servicing the vehicles and producing and marketing the gasoline required for driving them.

On the basis of these facts, it should be apparent that any means of increasing a nation's productivity is a boon to workmen, businessmen, and consumers alike. Statistics prepared by the United States Department of Commerce and Department of Labor show conclusively that whenever the rate of mechanization has gone up, the total employment has risen in like proportion the same year. Conversely, when the rate of mechanization has fallen off, employment has dropped.

Nevertheless, important developments that result in radical increases in productivity, always arouse cries of alarm from labor leaders and dire events are forecast. Automation has caused such a stir today in high labor circles—unwarranted in the light of past experience.

Charles O. Herb



Aimed right at your alloy needs

the world's largest alloy steel stocks

Thousands of tons of certified alloy steel in 1698 different sizes, shapes, analyses and conditions await your call at Ryerson. New leaded alloys are on hand in three different carbon ranges. Standard analysis steels are supplemented by a wide range of aircraft quality alloys. No matter what your alloy requirement, you can depend on Ryerson for quick delivery of highest quality steel.

You won't need to check or test your dependable Ryerson alloys before you use them because every bar has been spark tested and identified with its own heat symbol—every heat has been hardenability tested for you as part of an 8-step quality control plan. And should problems of application or fabrication arise, Ryerson al-

loy metallurgists will gladly put years of practical experience to work for you.

No order is too large to fill from stock, no order too small for quick personal service—so, next time you need alloy steel call your nearby Ryerson plant.

PRINCIPAL PRODUCTS

CARBON STEEL BARS - Hot

ALLOYS—Hot rolled, cold finished, heat treated.

STAINLESS—Allegheny bars, plates, sheets, tubes, etc.

TUBING—Seamless & welded, mechanical & boiler tubes.

STRUCTURALS — Channels,

PLATES—Many types including Inland 4-Way Safety Plate.

SHEETS—Hot & cold rolled, many types & coatings.

MACHINERY & TOOLS - For metal fabrication.

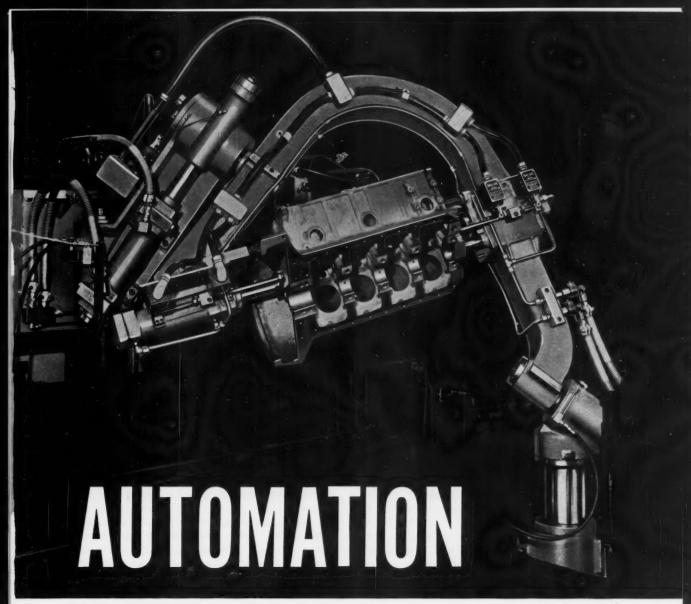


RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK . BOSTON . PHILADELPHIA . CHARLOTTE, N. C. . CINCINNATI . CLEVELAND DETROIT . PITTSBURGH . BUFFALO . CHICAGO . MILWAUKEE . ST. LOUIS . LOS ANGELES . SAN FRANCISCO . SPOKANE . SEATTLE

142-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257



Photo, Courtesy of Greenlee Bros. & Co.

The Metal-Working Industry's Philosophy for Increasing Productivity

By CHARLES H. WICK
Associate Editor

AUTOMATION is a relatively new word, having been coined about eight years ago. In the metal-working industry, the word originally meant the automatic handling or transfer of materials or work-pieces through a series of progressive manufacturing operations. The processing could be performed either in one com-

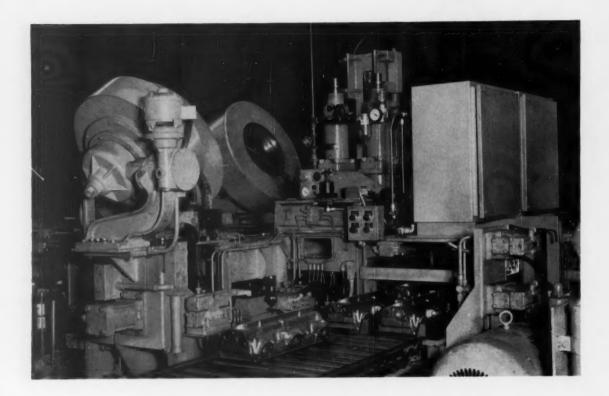
plex machine or in a series of machines, employing mechanical devices to load, transfer, position, inspect, and unload the parts.

Principles of automation are not new; the fact is they were developed long before the word was coined. Automation is a natural outgrowth of technological evolution, and is fundamentally an

Vol. 61 No. 7

MACHINERY

March, 1955



extension of basic mechanization and materialhandling methods. The name is associated with such well-known automatic equipment as transfer presses equipped with progressive dies, hopper feeds, automatic screw machines, and transfer type machines. Automation is therefore, an evolution, not an industrial revolution.

However, the word "automation" has caught the public's fancy and has skyrocketed into popularity. Also, its use by many varied industries has led to confused thinking and has made the precise meaning of the term debatable. Robot factories, push-button plants, automatic control, cybernetics, feed-back systems, and "a second industrial revolution" are some of the words and phrases frequently appearing in today's newspapers and magazines. Applications have spread to computation; the operation of airplanes and guided missiles; the control of temperature, pressure, and velocity; traffic control; the receipt, storage, and shipment of material or merchandise; and the control of cost accounting.

Chemical, petroleum, and food-processing industries are among those that have made the most headway toward complete mechanization and fully automatic plants. In fact, in the last-named industry, a mill near Philadelphia as long ago as 1784, processed wheat into flour unaided by human hands with a unique combination of belt, screw, and bucket conveyors. However, the

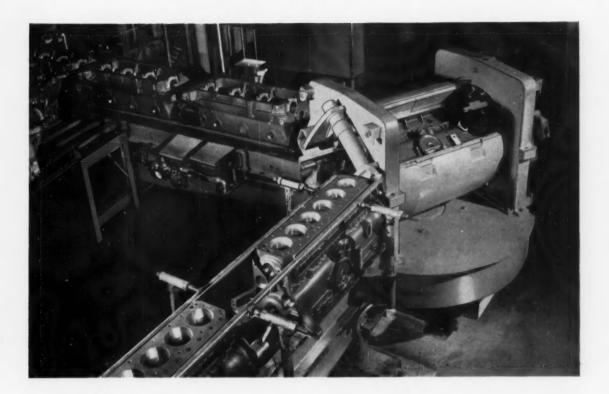
completely automatic metal-working plant is still in the future. Automation is a long step toward this goal.

Today, many executives in the metal-working industry will agree that automation has outgrown its original meaning—the automatic handling of parts in process. Now it is considered a new philosophy of manufacturing, starting with the design of the parts and the effect of the design on automation, the continuous flow processes for manufacturing them, and methods of controlling their production.

Need for Automation

Statisticians predict that product consumption will rise rapidly while the available work force will increase relatively slightly during the next ten years. To raise our standard of living—or even maintain it at the present level—industry must increase its productivity. Automation is a logical method of doing this.

Since automation equipment will, in most cases, save manpower, the age-old cry relating to serious unemployment has again been raised. The truth is that automation can create more jobs by providing more products at lower cost, and increasing the ability of people to consume. More efficient production has always resulted in more jobs. Manpower will be conserved by releasing it from tedious, tiring operations such as those in-



volved in loading and unloading machines, and handling parts between successive operations. Automation will require more "nonproductive" labor such as engineers, technical specialists, tool and diemakers, electricians, hydraulic repairmen, and maintenance personnel.

Another criticism frequently directed at automation is that it is only applicable to large mass-production plants such as those in the automotive industry. However, plants having subcontracts, and small factories producing a sufficient quantity of similar parts to permit fairly long production runs, can use automation. In fact, it will become an economic necessity for many smaller plants to adopt automation in order to meet the demands of today's highly competitive markets. The degree of automation to be employed by any plant will, of course, depend on the expected production of a particular part, the frequency with which the product design will be changed, and the amount of capital available for investment.

Automation Has Many Advantages

Among the many advantages that can be derived from successful applications of automation are the following:

1. Improved production efficiency. In many cases, the output of machines has had to be limited by the capabilities of the operator in

loading and unloading the machine. Automatic loading, transferring, and unloading of the work-pieces have made it possible to operate machines closer to their maximum rated productive capacity. One automotive manufacturing executive stated it this way: "Prior to automation, most machines operated at an efficiency of 65 per cent. Now, output from these same machines is at 80 per cent efficiency."

2. Improved product quality. By eliminating the unpredictable human factor with automatic material handling, processing, inspection, and assembling, more uniform parts and less scrap are produced. With automation, inspection equipment can be built right into the machines or made an integral part of the production line, thus improving product quality.

3. Lower production costs. Elimination of unnecessary handling, reduction of productive labor requirements, lower inspection costs, faster production, and less scrap are all features of automation which make it possible to trim manufacturing expense. Damage to the work-pieces is prevented since they do not strike each other or fall to the floor.

4. Greater safety. By eliminating hazardous manual handling of materials and work-pieces, employe safety is promoted. This is particularly true with automation devices for feeding parts into and ejecting them from presses.

5. Conservation of floor space. Increased production usually means additional manpower and costly expansion of manufacturing facilities. However, with automation, output can usually be boosted by using the same area or less. For example, an automated line in one automobile plant has an output of 2400 V-8 engines per day in the same floor space previously used to manufacture 1500 six-cylinder engines a day.

6. Improved working conditions. Automation reduces the physical effort required by the operators; and eliminates the need for repetitive and

tedious operations.

7. Reduced in-process inventories. Stocks of partially completed parts resulting from the breakdown or stopping of one or more machines are reduced when all operations are performed on either one machine or several machines tied together into one continuous production line.

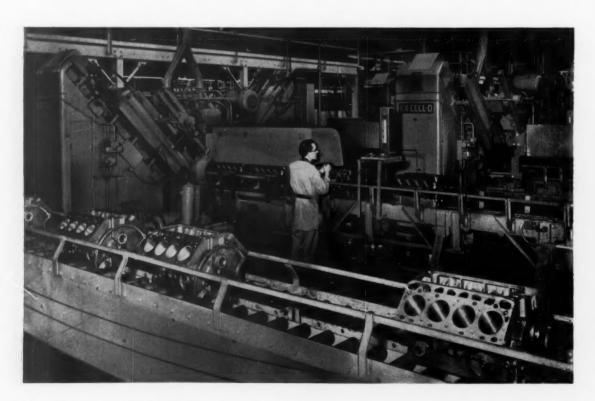
Disadvantages of Automation

As with any improved process or new method of manufacturing, certain limitations or objectionable features arise. One of the main objections to automation has been the loss of production resulting from either the breakdown or necessary stopping of automatic production, inspection, or assembling machines. However, this is becoming less and less a factor with

the improved reliability of automation equipment, the inception of sectionized or segmented automation, adequate electric control centers, faster and better control of tool changing, and the use of comprehensive preventive maintenance programs.

With sectionized automation, transfer machines are divided into sections to permit shutting down some sections without interfering with the production of others. Space is provided between successive sections for banking workpieces should the next section happen to be inoperative. Tool control boards are being widely used for storing sharpened, pre-set tools to minimize machine down time. Also, timing devices are provided on the boards to indicate when the tools should be changed.

An adequate preventive maintenance program is essential. Lubrication and other maintenance functions must be done on a fixed schedule. Also, comprehensive machinery and equipment records must be kept to determine the anticipated life of perishable tools and parts, so that they can be replaced before breakdown or failure occurs. Several plants have installed IBM systems for recording maintenance data on machines to determine recurring weaknesses and the life of components. Materials, processes, and equipment are standardized whenever possible to simplify maintenance by reducing the inventories that



146-MACHINERY, March, 1955

must be carried. J.I.C. standards are proving most helpful in improving identification, accessibility, operation, and protection of automation equipment.

Other objections to automation are the relatively high cost of special machinery and equipment, the length of time required for its design and construction, and the lack of flexibility. These objections are being overcome by increased standardization and the use of modular construction. Many transfer and other special machines are now being made from standard components, assembled in different ways to make machines for varying purposes. For example, the standard units used in a 350-foot long transfer machine for performing a total of 555 operations on V-8 engine cylinder blocks could be employed for seventy-seven single-purpose machines, such as tracer lathes, and milling, boring, drilling, reaming, and tapping machines. Thus, protection against obsolescence and increased flexibility are provided in case the special machine becomes unnecessary for the purpose originally intended.

Successful Automation Depends on Several Factors

The success of automation in any plant will depend essentially on proper application and sound engineering. Advance planning—starting with the design of the product—is vital. For a product already in production, automation should be applied progressively to various parts of the product. All costs and savings should be carefully analyzed to obtain an optimum balance between efficiency and economy. Automation equipment should pay for itself during the life expectancy of a product. However, with increased standardization, modular contruction, and flexibility, there is more opportunity of using the equipment for purposes other than originally intended.

Several companies have established separate automation departments. These departments study the adaptability of parts to automation; consult with plant lay-out, production, and tool engineers; and make cost studies.

Since a high degree of operating perfection is required, sound engineering principles must be applied in the design of the product, automation equipment, and cutting tools. Also, creative thinking is necessary in planning the more involved electrical circuits and complex hydraulic systems for automation devices.

Automation has definitely proved its worth, and its application will undoubtedly spread widely during the next few years. This special issue of Machinery should be a valuable reference in helping metal-working concerns to decide where and how automation can be used to best advantage in their own plants.





To reduce production costs, minimize down time, and obtain maximum efficiency, an intensive study must be made of the cutting tools to be employed. This analysis should be made at the time the transfer machine is proposed, and estimated tool-change times should be developed

Preamers, and milling cutters can be the most important single factor affecting the economy and efficiency of transfer machines. Automation creates a real need for the careful selection of dependable, high-quality cutting tools, as well as fast, accurate, and safe methods of changing the tools. It has been estimated that down time for changing tools represents more than 75 per cent of the total production time lost for all reasons on such machines.

To overcome this, the practice of The Cross Company is to make a comprehensive analysis of tooling problems and cutting tool selection before contracting to build a Transfer-matic. This study is made at the time the transfer machine is proposed.

Typical of such studies is the one made for the huge Transfer-matic described in December, 1954, Machinery, page 192. This 350-foot long transfer machine performs a total of 555 operations on V-8 engine cylinder blocks. With a drawing of the engine block for reference, a proposed machine drawing was prepared. Each head on the machine was identified by a different letter. The letters identifying the various heads also indicate the positions of the heads on the transfer machine. Starting from the loading opera-

tor's position and proceeding down the left side of the machine and then down the right side, head identification letters are assigned in alphabetical sequence.

Project engineers in charge of designing the machine are responsible for the selection of the tooling. In addition to their background and experience with cutting tools, engineers are guided in tool selection by the records which have been accumulated from many previous installations of similar machines. From such information, tool lay-outs are prepared. These lay-outs contain pertinent information regarding the cutting tools, bushings, adapters, and clamps required. Also, data concerning the operation of the cutting tools, such as feed rates, speeds, and strokes, are included to facilitate subsequent design of the various heads.

A typical tool lay-out that was prepared for the V-8 engine block Transfer-matic mentioned is shown in Fig. 1. This particular lay-out is for head C, the third head on the left-hand side of the machine, which is located at Station 8. In preparing any tool lay-out, a standard list of information required for each machine spindle is followed. This information includes the spindle number; station number; head letter; tool number; adjustable adapter body and nut numbers;

Importance of Cutting Tools in Transfer Machining

By RALPH E. CROSS, Executive Vice-President The Cross Company, Detroit, Mich.

collet, chuck, holder, or driver number; the diameter of the cut or cutter; number of teeth on the cutter; depth and length of cut; cutting speed of tool in feet per minute; revolutions per minute of the spindle; and the feed of the tool in inches per revolution.

Also, for pre-set tools, the gage setting length is specified on the lay-out. Standard components are used whenever possible and the spindles are fitted to length at assembly to make them alike for pre-set tools. The spindles are identified by two numbers separated by a dash, the first number representing the spindle itself (which corresponds to the number identifying a particular hole or surface) and the second number is the station at which the spindle is located.

From the information on the tool lay-out sheets, a data sheet such as the one shown in Fig. 2 is prepared. This sheet is a summary of all the tooling on a transfer machine-or on one section of the machine, if it has been divided into sections for sectionized automation. This Transfer-matic for V-8 engine blocks was divided into five working sections, with storage space for banking the blocks provided between successive stations. The data sheet illustrated was prepared for the first section of the machine, and was used to design one of the seven machine control units placed conveniently along the line to service all tools. Size and lay-out of the machine will determine the number of machine control units provided for convenience in changing tools.

The machine control units contain gages for pre-setting the depth to which the tools will cut; storage panels for holding properly assembled, pre-set, and sharp tools; and Toolometers for programming tool changes. Toolometers are cycle or piece counters having a graduated dial face, a stop or set hand that is fixed at the predetermined life of the particular tool, and an indicator hand. One Toolometer is provided for every tool

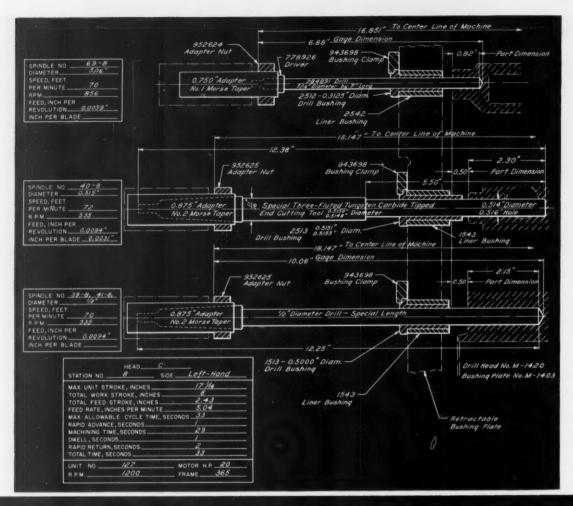
or group of similar tools on the machine, and is electrically interlocked with the machine cycle.

Every time a work-piece is produced, the indicator hands on the Toolometers index a small amount counter-clockwise from the set hands toward zero marks on the dials. The indicator hands give a continuous reading of the number of parts than can still be produced before the tools require changing. A red area on the dial face warns that a necessary tool change is approaching. When one of the indicator hands reaches its zero position, the section of the machine to which the Toolometer is connected becomes inoperative and a red light on the main push-button station of the machines goes on.

The operator then knows that it is time to change tools, as well as which tools to change. When the machine is down for necessary tool changes, or for any other reason, all tools having their indicator hands in the red areas on the Toolometers are changed to prevent having to stop the machine again within a short time. The indicator hands are reset after making the corresponding tool changes by moving them in a clockwise direction back to the stop or set hands.

Sufficient information is supplied on the tool lay-out sheets to fill in most of the columns on the data sheet. In the third column, the color of the tool storage areas on the machine control unit is specified. A color code is used to identify the position of the head with relation to the center line of the transfer machine. Yellow is used for horizontal and angular heads on the righthand side of the machine, red for similar heads on the left, dark blue for vertical heads, and light blue for rear heads. Gage storage areas on the unit are painted gray, with black lines separating the gage, tool, and Toolometer areas.

The fifth column on the data sheet refers to the number of holes placed in the tool board for storing tools. This number will vary with cus-



HEA	COLOR	SPINDLE NO.	NO. OF HOLES	BOARD HOLE SIZE	LIFE	SAME AS METER	TYPE OF TOOL & NO.	BLADES	DRIVER	HOLDER	ADAPTER SIZE & NO.	NUT	GAGE DIM. A	TYPE	SAME GAGE AS	REMARKS
A	RED	20-1	2	2-1/8° THROUGH	3900		1.041" BORE N-1103-3	#-1403-23			H-1903-3	952829	6.70*	BAR		
		19-3	2	2-1/8" THROUGH	3900	20-2	1.875" ROUGH BORE 1.031" SEMI-FINISH	(3) # 1233-12			H-1903-9	962929	12,56°	949		
D	858	10-5	,2	1/2" TeRouse	1000		7/16" x 8-1/8" ORILL 784925		778934		952619X	952428	7.86*	BAS		
С	RED	38-8 and 61-8	4	9/16° THROUGH	1000		1/2" x 12-1/4" BRILL M-1403-5				952814X	962825	10.08*	BAR		
		10-2	2	3/4" THROUGH	2900		0.514" END CUTTING 100L m-1403-50				9526141	952875	10.06*		29-6	
		67-8 799000H 71-8	10	3/8" THROUGH	2000		5/16° DRILL 784891		778026		9526133	952624	4.88*	BAR		
		73-8 and	4	3/8" THROUGH	1800		5/16" DRILL 784801		778926		052613X	952829	6.88*		67-8	
		39-9 60-9 and 61-9	4	9/16" THROWSH	1000		1/2" x 14.56" DRILL H-1903-7				952614X	952625	12.36*	BAR		
		\$1-3 and	4	5/8° THROUGH	1909		9/16° x 8-5/8° DRILL 785531		778942		952618X	952827	8.18*	BAR		
		(90-9 and (91-9	4	1-15/16" x	3000		1.597* BORE H-1403-8			#- (NO3-9		952627	6.00*	CHANGER		1.68" EFFECTIVE DIAMETER : 90 CHAM
0	RED	39-11 90-11 and 91-11		0/16° THROUGH	1200		1/2" x 15.06" DRILL N-1403-11				9528193	952625	12.87*	BAR		
		67-11 THROUGH 73-11	14	1/2" THROUGH	10000		7/16" x 7-1/8" CORE ORILL H-1403-12		778934		952618X	952627	6.68*	CHAMFER BAR		0.375" EFFECTIVE DIAMETER # 90 CHAMFER
		34-12, and 40-12 and 41-12	6	9/(6" THROUGH	1200		1/2" x 17" DRILL 9-1403-13				9526144	952825	19.841	SAR		
		\$1-12 and		13/16° THROUGH	10000		9-1403-14 04177 3/4, x 0-44, COME		778954		962620X	952628	5.68*	CHAMFER		0.680" EFFECTIVE DIAMETER * 90" CHAMFER
E	RED	39-14, 10-15 and 51-14	6	B/16" THROUGH	1200		1/2" x 19-1/4" BRILL 0-1403-15				9526193	952625	17.06*	949		
		39-15 and 40-15 and 41-15		9/16" TRROUGH	1200		1/2" x 20.06" DRILL M-1403-18				952814X	962626	18.87*	BAR		
P	RED	75-17 and 74-18	-	1/4" TwRouds	1200		3/16" x 4-3/4" ORILL N-1403-18		778919		952813X	952824	1.58*	BAR		
	RED	39-21 THROUGH 41-21	6	3/4" THROUGH	3000		0.515" SUB-LAND REAMER N-1403-19				952619X	952625	6.330	CHAMFER BAR		0.635" EFFECTAVE DIAMETER = 90" CHAM
		65-21 and 66-21	4	5/8" THROUGH	3000		0.580" BEAMER N-1903-20				952617X	952627	6.79*	CHAMFER BAR		0. 00" EFFECTIVE DIAMETER × 90 CHAM
		80-2 and	4	1-15/16" x	5000		1.6275" FINISH BORE H-1908-71			10-1403-9		952627	6.50*	CHAMFER BAR		1.62° EFFECTIVE DIAMETER # 90° CHAM
J	RED	76-27	2	1/4" THROUGH	1200		3/16" x %-3/4" DRILL H-1403-18		778919		9526131	952624	4.95"	841		
E	853	20-20	2	MODO YOKES	3000		OIL SROOVE ARSON IN-1403-95	# 1903-25						MOM E		

Fig. 1. (Top, opposite page) Tool lay-out for the third head, Station 8, on the left-hand side of a transfer machine which performs 555 operations on V-8 engine cylinder blocks

Fig. 2. (Bottom, opposite page) Data sheet prepared from the tool lay-outs (see Fig. 1) is a summary of all tooling in first section of V-8 engine cylinder block Transfer-matic.

tomer preference, but normally three sets of tools are supplied—one for operation on the machine, and two for storage on the machine control unit after the tools have been sharpened, assembled, and pre-set. The size of the holes will, of course, depend on the design of the tools.

A drawing of the work-piece and the tool layouts are utilized in selecting the type of gages or fixtures to be used for pre-setting the tools. The tolerances to be maintained in machining various holes and surfaces will determine the type and complexity of gage required. Normally, bar type gages such as the one seen in Fig. 3 are provided. With this type gage, the tool is inserted vertically in a hole in the master tool-setting fixture and adjusted upward in its holder until its point contacts the gage bar. Such gages are generally restricted to applications having a tolerance of plus or minus 0.010 inch or more on the length.

Flush pin type gages, like the one shown in Fig. 4, are frequently employed when tolerances must be held to plus or minus 0.005 inch. Also, special gages are sometimes required for more complex cutting tools, or when closer tolerances must be held. One such gage, which makes use of a dial indicator for pre-setting the tool, is illustrated in Fig. 5.

In the column on the data sheet headed "Life," the predetermined tool life is inserted. To make such an estimate, reference is made to a drawing of the work-piece, the tool lay-outs, and the data sheet, as consideration must be given to the amount of work to be done by each tool. Also, previously accumulated tool life reports from similar operations are reviewed and serve as a guide in determining correct tool life estimates. An accumulation of valuable knowledge is being built up by reports from transfer machines that are in operation in various plants.

Many plants are keeping records of machine down time for the replacement and sharpening of tools, as well as tool consumption for various operations. In cases of high tool consumption,

Fig. 4 (Right) When tolerances of plus or minus 0.005 inch or less are maintained in pre-setting tools, a flush-pin type gage such as this one is frequently employed.

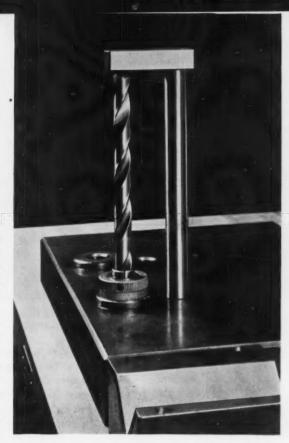


Fig. 3. Typical bar type gage for pre-setting cutting tools before they are mounted on the transfer machine. Over-all length is increased until drill point contacts the gage bar.



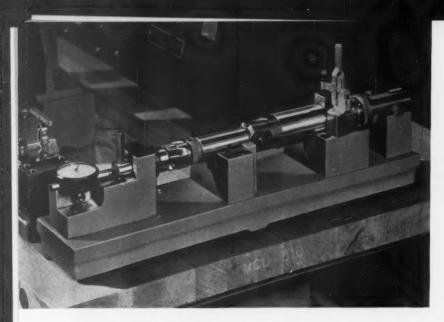


Fig. 5. Special pre-setting gage makes use of V-block supports, a quick-acting clamp, and a dial indicator for adjusting the over-all length of multiple-diameter boring tool.

a new tool or tool material may be substituted, or the cutting speed or feed modified.

Several large automotive concerns are now collecting such information by means of IBM systems, using punched cards for tabulating results. One typical Tool Life Record card is shown in Fig. 6. Such cards carry pertinent information about the work-piece and tool, the machine control unit number, the head letter, and station and operation numbers. The cards are kept in envelopes at the machine control units. When the job setter removes tools for any reason, he fills in the left-hand side of the card in pencil—indicating the date, shift number, Toolometer setting, Toolometer reading, and reason for removing the tools. Then he takes the card, with the tools, to the grinding room.

A card is required for the job-setter to receive new or sharpened tools. In the tool grinding room, an analyst inspects the tools, indicates whether they could have been operated longer or were run too long, and makes pertinent recommendations or remarks on the right-hand side of the card. The information on these cards is tabulated on a Tool Life Record sheet, Fig. 7. Study of such sheets provides the information necessary for Toolometer adjustments, as well as for tool life comparison tests, tooling requirement budgets, and new tool orders.

Using all such available information and past experience to estimate tool life, a Tool Life Summary sheet, Fig. 8, is prepared. On this sheet, surface conditions of the work-piece which seriously affect tool life are indicated by code numbers selected from those listed in the accompanying table. For example, in machining the cylinder block with the tungsten-carbide bladed, end-cutting tool mounted on spindle 40-8, head C, a surface condition code of 2-12-13-17 is listed. These successive numbers indicate that the hole is

Fig. 6. Tool Life Record card for use with IBM tabulating system contains information about when tool was removed from the transfer machine, and the reason for removing it.

76 MCU NO	HEA	DITA	A NO	B		TOOL	. NU	MBE	R	STY.		то	OL	DESC	RIPTI	ON			P.	ART N	AME		PART NO	UMBER	20
	NO. THE SAME OF TH		BAY		ROKI	ETE	3	S F DOLO SATOR	METE	SIZ FIN R SI	E ISH	ETTIN	6	WETER	WHE	N CHAN	#G€ D	R		COULE	E FOR TO HAVE	RUN			Y
	51	GNA T	URE	109	82 7 7	ER					ī	CHATUR	re.	FOREWA	N						,	BIGNATU	*E TOOL	ENGIN	169

Fig. 7. Information on cards, Fig. 6, is tabulated on this Tool Life Record sheet for subsequent adjustment of Toolometer readings and tool life comparison tests.

CYL	BLOG art Nam						312863 Part Numb	er O	pe rati	on or	Machine ANALYSIS CODE
	1567		Qty per Set				MCU No. 5/16 Drill Tool Descri				B BROKEN O OTHER B BULL X COMPLETED TOOLOG F FINISH L COULD HAVE RUN LOW S SIZE R RAN TCO LONG
	POSITION		0	DAY		40.00	TOOLOMETER SETTING		© € A30H *00L 	AMRS.	COWWENTS
76 C C	7 7 7 7 7 7 7 7 7 7 7 7	8 8 8 8 8 8 8 8 8	666666666	2500	4444	110 11 110 11 110	1800 1800 1800 1800 1500 1500 1500	1890 1800 1600 1600 1500 1500 1500	X X X X X X	20.00	

started into a rough-cast surface; the operation consists of enlarging a previously machined hole; the operation is end cutting; and two inline holes are machined in one operation.

Taking all of the tabulated facts into consideration, an estimated tool life (initial dial setting) is filled in on both the data sheet and Tool Life Summary sheet. Space is provided at the right on the Tool Life Summary sheet for adding service reports on tool life received after the machine has been placed in operation, and a final dial setting based on these service reports.

With all of this data, it is possible to prepare a Tool Change Labor Estimate sheet, Fig. 9. In the boxes at the top of this sheet, pertinent information describing the machine is filled in. Box 4,

100 per cent production, is for hourly productive capacity of the machine when it runs continuously without a break. For the V-8 engine cylinder block Transfer-matic under discussion, the castings are loaded while the machine is running. Thus, only the forty-second cutting cycle for this machine establishes its productive capacity. The 100 per cent production figure is obtained from the formula:

For this machine:

$$\frac{3600}{40} = 90$$
 pieces per hour.

Characteristic Code Numbers for Surface Condition Column of Tool Life Summary

Machining Holes

Entering Characteristics

- 1. Hole starts into a finished surface.
- 2. Hole starts into a rough cast or forged surface.
- 3. Hole starts into a cored surface.
- 4. Hole starts angularly into a finished surface.
- 5. Hole starts angularly into a finished surface which is spot-faced prior to drilling.
- 6. Hole starts angularly into a rough cast or forged surface.
- 7. Hole starts angularly into a rough cast or forged surface which is indented to assist entrance of tool.

Machining Characteristics

- 11. Blind hole.
- 12. Enlarging a previously machined hole.
- 13. End-cutting operation.
- 14. Sizing operation.
- 15. Hole machined in a series of steps.
- 16. Machining two diameters in one operation.
- 17. Machining two holes in line in a single operation.

Break-Through Characteristics

- 21. Hole breaks through perpendicularly into either rough cast surface or finished surface.
- 22. Hole breaks through into a small cast ra-
- 23. Hole breaks through partially into a cast wall.
- 24. Hole breaks through into a previously machined hole.
- 25. Hole breaks through angularly into either rough cast surface or finished surface.

Machining Surfaces

- 51. Face-milling.
- 52. End-milling.
- 53. Slotting or notching.
- 54. Slab-milling.
- 55. Frequently interrupted surface.

Special Conditions

- 71. Soluble oil and water used for coolant.
- 72. Cutting oil used for coolant.
- 73. Oil mist used for coolant.

The number of cylinder blocks required per hour to keep the assembly line of the plant in full operation (in this case 60) is inserted in Box 5, Line Production. Box 6, the required operating efficiency of the equipment to attain line production, is obtained by dividing the line production by the 100 per cent production. For this

example, the efficiency would equal $\frac{60}{90}$, or 67 per

cent. The maximum allowable down time per shift, Box 7, is obtained by multiplying the efficiency by the number of hours in the shift, and subtracting this product from the number of hours in the shift. In this case,

$$8 - (0.67 \times 8) = 2.64$$
 hours.

Columns 8, 9, 10, and 12 can be filled in from information on the data sheet. For Column 11, the time required in hours to change each tool is estimated. This estimate is based on past experience and, for pre-set tools, is relatively low since no trial cuts or measurements of the work-pieces are necessary. The figures in Column 13 are ob-

tained by multiplying those in Column 11 by the ones in Column 12.

A tool factor, representing the number of grinds or resharpenings that each tool will require per eight-hour shift, is entered in Column 14. These factors are obtained from a Tool Factor Graph, Fig. 10. For example, to find the tool factor for the 5/16-inch diameter drill on head C, which has been underlined in Fig. 9, we proceed in Fig. 10, as follows. Starting at the left with the number of pieces per grind-1800-a horizontal line (indicated by broken line) is followed until it intersects the diagonal line corresponding to the 100 per cent production figure, which in this instance is 90. Then the vertical broken line is followed until it intersects a second horizontal line corresponding to the machine efficiency—67 per cent. The upper diagonal line which passes through this intersection point is the tool factor—in this case, 0.27.

Column 15, Change Hours Per Shift, in Fig. 9 is completed by multiplying together the figures in Columns 13 and 14. For the 5/16-inch drill

Fig. 8. Tool Life Summary sheet combines all available data. Surface conditions which tool will encounter in machining work-piece are indicated by code numbers selected from a table.

		T	HE CRO	SS COMPAN	VY				1						
			TOOL LI	FE SUMMARY					1				SECTION 1	- LEFT	
												PRO	JECT NO	7009	
					TYPE TRAN	SFER-MATIC							ES ORDER	4154	
PLANT						MDER BLOCK						м с	U. SER. NO.	400	
	HE MFGR. CROSS					I RON							U. P.O. NO	N-8191	
	NE NO. 2344-1				OPERATION								ET_1_OF		
		FEED	CUTTING		HOLE O	ATA	CUTTER	DATA		HITIAL	-	-	PORTS ON LIFE		FINAL
HEAD	SPINDLE NUMBER	IN, MIN,	FY, MIN.	OPERATION	BIAMETER	DEPTH	MAT'L	BLADES	SURFACE CONDITION	SETTING	1 ST	2 ND	3 RD	4 TH	SETTIN
A	20-2	4,18	106	Bore	1.9425*	1.36*	Tungsten Carbide	4	3-13	3000					
	19-3	4.18	106	Bore	1:075"	0.80"	Tungsten Carbide	2 2	3-12-13-16	3000					
	40-5	3.44	70	9rill	7/16°	1.28*	high-Speed Steel		2-25	1000					
C	39-8 and 41-8	5.04	70	Drill	1/2"	2.15*	High-Speed		2-11	1000					
	40-B	5.04	72	End-Cutting	0.515°	2.30*	Tungaten Carbide	3	2-12-13-17	3000					
	67-8 through 71-8	5.04	70	Drill	5/16*	0.96"	Nigh-Speed Steel		1-11	2000					
	72-8 and 73-8	5.04	70	Drill	5/16"	1.00*	high-Speed Steel		1-25	1800					
	39-9, 40-9 and 41-9	5.04	70	Drill	1/2"	2.31"	Bign-Speed Stoel		11-15	1000					
	65-9 and 66-9	5.04	70	Dritt	9/16"	1.12*	High-Speed		1-25	1200					
	190-9 and 191-9	5.04	120	Bore and Chamfer	1.5045*	0.44"	Tungsten	4	3-13-16	3000					
D	39-11 through	4,65	70	Dritt	1/2"	1.95*	high-Speed Steel		11-15	1200					
	67-11 tarouga 73-11	4.65	70	Cnamfer	0.375"	0.63*	High-Speed Steel	3	1-12	10000					
	39-12 through	4,65	70	Drill	1/2"	1.97"	high-Speed Steel		11-15	1200					
	65-12 and 66-12	4,65	40	Chamfer	0,68"	0.06"	High-Speed Steel	3	1-12	19000					
1	39-14 tarouga 41-14	4.65	70	Drill .	1/2"	1.82"	high-Seed Steel		11-15	1200					
	39-15 through 41-15	4.65	70	Drill	1/2"	1.81"	high-Speed Steel		11-15	1200					
F	75-17 and 74-18	4.30	70	Drill	3/16"	0.75*	High-Speed Steel		4-25	1000					
6	3#-21 through 41-21	7.70	70	Resm and Chamfer	0.515" 0.635"	0.41°	Tungsten Carbide	6	1-12-14-16	3000					
	65-21 and 68-21	7.70	70	Ream	0.595°	1.00"	Tungsten Carbide	6	1-14-25	5000					
	190-21 and 191-21	7.70	110	Bore	1.6275*	0.44"	Tungsten Carbide	4	1-14	5000					
,	76-27	4,30	70	Brill	3/16*	1,66"	High-Speed Steel		4-25	1000					
	20-30	17,30	250	1.8125 Diam. Side-Mill	2.26"	0.20" Wide	Tungsten Carbide	12	53-16	3000					

0	* 1000	37035 90 1.9425" Dia 1.875" and	tone source 50 gas	PICES PER GRACE	Y WAY	mus 80		2,64	1 of 1
0	P HEAD	1.9425" Dia 1.875" and	M. Bore	10	CHANGE	10		2,64	
	A B	1.9425" Dia 1.875" and	100L SEE A NAME	10	CHANGE	10			HOUR
the state of the s	A B	1.9425" Dia 1.875" and	m. Bore	-	CHANGE		19		
	В	1.875" and			1004	10018	TOYAL CHANGS HOURS	root rectos	CHANG HOUR ROUR Sepa Smith
	-			3000	0.10	1	0.10	0.16	0.01
The state of the s	-	District	1.9315" Diam. Bores	3000	0.10	1	0.10	0.16	0.01
	C	7/16" Diam	Drill	1000	0.76	1	0.06	0.49	0.02
		1/2" Diam.	Drill	1000	0.05	5	0.25	0.49	9.12
		0.515" Diam	. End-Cutting Tool	3000	0.06	1	0.06	0.16	0.010
		5/16" Diam	Drill	2000	0.05	5	0.25	0.28	0.070
		5/16" Diam.	Drill	1800	0.06	1	0.12	0.27	0.033
		9/16" Diam.	Drill	1000	0.06	2	0.12	0.49	0.05
		1.5965" Dia:	m. Bore and 1.68" Chamfe	т 3000	0.06	2	0.16	0.16	0.03
-	D	1/2" Diam.	Drill	1200	0.05	6	0.30	0.41	0.123
		0.375" Diam	. Chamfer	10000	0.05	3	0.35	0.05	0.017
0 1		0.68" Diam.	Chamier	10000	0.06	2	0.12	0.05	0.006
	E	1/2" Diam.	Drill	1300	0.05	6	0.30	0.41	0.123
	F	3/16" Diam.	Drill	1000	0.06	2	0.12	0.49	0.059
- 1	G	0.515" Diam	. Reamer and 0.635" Cham	ier 3000	0.05	3	0.15	0.16	0.02
		0.595" Diam	. Reamer	5000	0.08	2	0.12	0.10	0.012
		1.6275" Dias	n. Bore	5000	0.10	H	0,20	0.10	0.020
	J	3/16" Diam.	Drill	1000	0.06	1	0.06	0.49	0.025
	К	1.8125" Dias	n. Side-Mill	3000	0.30	1	0.20	0.16	0.032

underlined, the change hours per shift equals 0.12 times 0.27, or 0.032 hour. The total of Column 15 (0.825) is the number of hours required to change all fifty-two tools in an eighthour shift. Since the maximum allowable down time per shift is 2.64 hours, the operator has a surplus of 2.64 less 0.825, or 1.815 hours per shift over and above the time required to make the production quota and change tools.

Such tool change labor estimates are most valuable, particularly if they are made at the time the machine is proposed, since they serve as guides for the engineer in designing the machine. For example, the estimates will show whether too many operations are being combined for the specified operating efficiency, and which tools will cause the greatest amount of down time. From such information, it might become necessary to divide the operations into simpler forms, eliminate certain tools from the machine, or balance out the sections of the machine to equalize the down time in each section. The figures also show how many tool-setters should be provided to assist the operator in changing the tools.

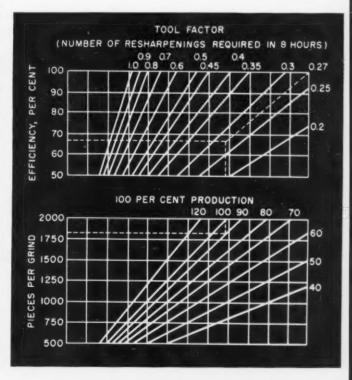
After the machines have been placed in opera-

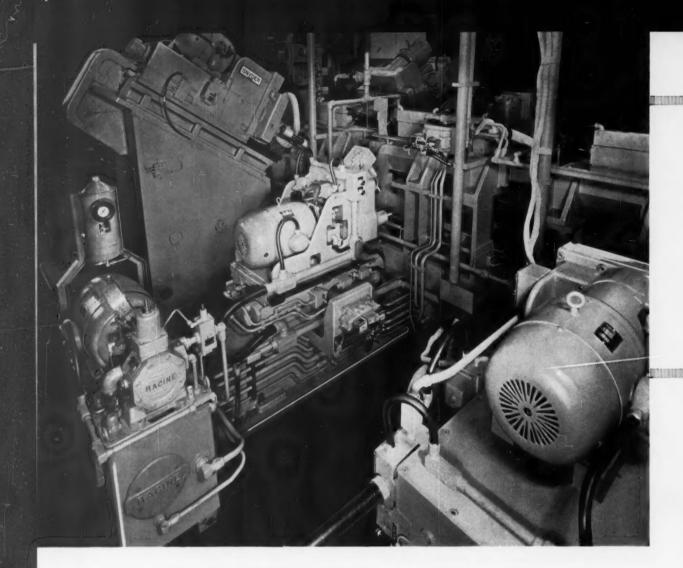
Fig. 10. Graph for selecting tool factor representing number of resharpenings required per eight-hour shift. Example (broken line) is for drill underlined in Fig. 9.

Fig. 9. Total of Column 15 (0.825 hour) on this Tool Change Labor Estimate shows that operator has ample time to change tools, since 2.64 hours of down time are allowed.

tion, the estimates as well as the tool life records, Figs. 6 and 7, provide standards of performance for all tools on the machine and show when each individual tool should be changed. If certain tools do not perform in accordance with these standards, they get immediate attention, and the causes of substandard performance are soon eliminated.

By means of such comprehensive analyses, carefully kept tool life records, and a well-planned tool control program for improving tool performance, one manufacturer of automotive engines has been able to reduce the cost of new tools requisitioned from stores from \$2.75 to \$1.75 per engine block. Another producer of V-8 engines has cut the same cost from \$1.88 to 63 cents per block. These considerable savings have been realized from resharpening tools at fixed intervals. Previously, with uncontrolled grinding, tools would frequently be run too long, resulting in burning or chipping and making it necessary to remove excess tool material during sharpening. Also, by replacing the tools before they break, new tool costs are reduced substantially and more resharpenings are possible before the tools have to be replaced.





Successful automation depends on creative thinking in the application of sound engineering principles. To insure dependability, provide safety, minimize down time, and increase the efficiency of automation applications, more complicated electrical circuits and intricate hydraulic systems have become necessary. Examples of hydraulically operated, electrically controlled components employed on transfer and rotary indexing machines will be described in this article.

One major use for hydraulic power in transfer machines is the movement of the work-piece into the machine, between stations, and out of the machine. Hydraulic cylinders for this purpose are equipped with acceleration and deceleration valves in the ends of the cylinders, and flow-control valves for regulating the speed of transfer. Pressure is supplied from a motor-driven pump and reservoir. The diameter, stroke, mounting dimensions, and construction of the cylinders are standardized whenever possible to facilitate maintenance and reduce the number of spare parts required.

Actual transfer of the work-pieces can be accomplished in several ways. Frequently, the piston-rod of the hydraulic cylinder is linked to a bar carrying counterweight type gravity pawls which slide the parts along rails. The pawls are raised into transfer position by the counterweights, and depressed by the work-pieces on the return stroke. Sometimes, sliding of the work-pieces is done by rotating transfer bars having fingers which contact and push the parts. Another method employed where sliding is not permissible, is the walking-beam type transfer. With this set-up, the work-pieces, resting in cradles, are lifted off stationary locators by pivoting levers, advanced the required distance, and lowered onto the next locators. These levers are actuated by hydraulic cylinders.

Another application of hydraulics in transfer machining is the location and clamping of parts at various stations. The work-pieces, or fixtures on which they are carried, are usually positioned by dowels or locating pins, and clamped against the rails or pads at each station. Both clamping and operation of the locating pins can be accom-

Hydraulic Systems and Electrical Controls for Automation

By WILLIAM C. GOECKEL
Snyder Tool & Engineering Co.,
Detroit, Mich.

Hydraulic cylinders, motors, and valves; and electrical switches, solenoids, timers, wiring, and control devices are becoming increasingly important in such automation applications as the locating, clamping, and transferring of work-pieces, as well as the feeding of various machining, inspecting, and testing units

plished by hydraulic cylinders, or hydraulic motors geared to clamp screws.

Hydraulic power is also employed for feeding and retracting various machining, inspecting, or testing units on transfer or other special machines. Standard way type feed units have a saddle which moves back and forth on a slide, or set of ways, by means of a hydraulic cylinder. Movement can be controlled to provide rapid advance of the unit, feed at the pre-set rate, a dwell, if desired, and rapid return. Length of the feed and traverse strokes can easily be adjusted by changing the positions of dogs on the sides of the units. With full-depth control, which is provided on long transfer machines where operator visibility of the various stations is limited, each head must make its complete cycle before relays are actuated and the work-pieces can be transferred to the next station.

A typical transfer machine would have an electrical circuit controlling a solenoid-operated hydraulic valve for actuating the transfer cylinders. After transfer has been completed, other hydraulic valves are energized for work-piece

locating and clamping. A limit switch at each station is closed as each part is clamped; when all these switches have been closed, the circuits controlling the feed of the various tool-carrying units are completed.

The hydraulically operated, electrically controlled feed unit circuit, shown diagrammatically in Fig. 1, is a standard basic circuit used frequently on transfer machines. The slide for the unit is represented by line A, the adjustable control dogs are shown at B, and the hydraulic operating cylinder is seen at C. Direction of piston travel—for feeding or retracting the unit—is controlled by the four-way hydraulic valve D. This two-position directional valve is spring offset, solenoid-controlled, and pilot-operated. By energizing either solenoid, the valve spool is moved and oil is directed to one or the other end of the cylinder.

During rapid traverse of the unit, cut-off valve E and metering flow control valve F are actuated to slow the piston travel to the desired feed rate. When the unit reaches the end of its feed stroke, limit switch G is closed, direction of the oil flow

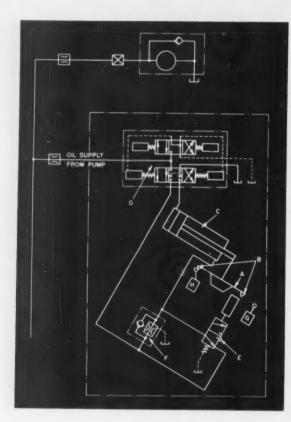


Fig. 1. Basic hydraulically operated, electrically controlled circuit which is frequently employed for various purposes on transfer machines. In this case, cylinder (C) feeds machining unit along slide (A).

is reversed, and the unit is rapidly retracted. At the return end of the stroke, limit switch H is closed, thus completing the circuits which unclamp and index the work-pieces.

Although most transfer machines are special, single-purpose pieces of equipment, they are sometimes designed to handle more than one production part. For example, the Snyder twenty-two station machine illustrated in Fig. 2 can accommodate two different automotive intake manifolds—one for engines having a two-barrel carburetor, and the other for engines with a four-barrel carburetor. To change from the production of one part to another, a master selector switch is turned. This either adds several machining heads to the operation cycle, or makes these heads inoperative.

Also, transfer machines may be divided into sections separated by inspection stations, storage areas, or fixtures that rotate the part. Such machines can be arranged with electrical control circuits and selector switches so that one or more sections can be shut down, or placed on manual control for tool changing, while the other sections can be operated automatically.

An unusual feature of the Snyder twenty-one station transfer machine, Fig. 3, is that stations

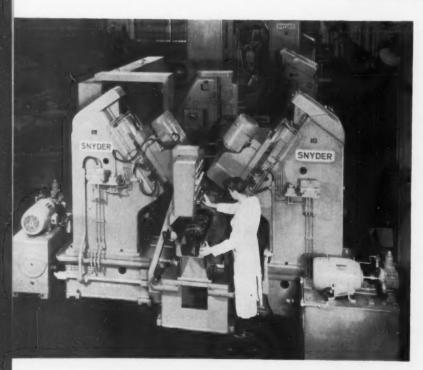


Fig. 2. Transfer machine having twenty-two stations is used in producing two different intake manifolds by employing certain heads on one part and making them inoperative on the other.

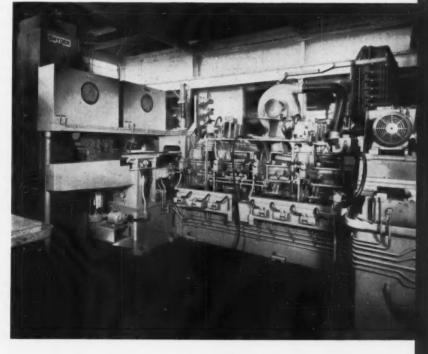
Fig. 3. Intake manifolds are automatically tested for both leakage and volume while being processed on this twenty-one station transfer machine. Unsatisfactory manifolds are automatically ejected.

are included for automatic testing of the intake manifolds being processed. At the leak testing stations, all of the manifold outlets are sealed by hydraulically applying rubber pads. Then, compressed air is introduced, and the pressure drop over a fixed period of time is measured. In testing for air volume flow, the required volume of air is blown through the manifold passages. Any restrictions in the air passages (such as those caused by casting fins) are detected by a rise in pressure. This pressure rise is indicated on a gage at the inlet.

Intake manifolds found defective at any of the four testing stations are automatically ejected at a subsequent station, seen at the left in Fig. 4. This is accomplished by means of a memory circuit consisting of a continuous chain passing through the four stations. The chain is driven by the hydraulic transfer device and carries solenoid-actuated pins. If a manifold is found unsatisfactory, one of these pins is automatically raised. At the ejection station, the raised pin contacts a limit switch to actuate a hydraulic cylinder for removing the manifold from the machine. Raised pins are automatically lowered as the continuous chain returns them to the testing stations. Satisfactory parts continue through the



Fig. 4. Side view of testing and ejection stations on automatic transfer machine seen in Fig. 3. A memory circuit containing solenoid-actuated pins is used in rejecting defective manifolds.



MACHINERY, March, 1955-159

transfer machine to subsequent stations for additional machining.

A control board, or console, is provided at the loading station of each transfer machine. These consoles contain all the necessary push-buttons and switches for starting and stopping the machine, clamping and unclamping the work-pieces, and other functions. Also, signal lights are provided to indicate when the parts have been indexed, clamped, or unclamped; and when the heads have been fed to full depth or retracted.

MASTER CONTROLS A-SECTION CONTROLS • • STOP SET (6) ON 0 0 0 0 MANUA 0 0 0 0 0 (A) INDEX HEADS BACK 6 FULL DEPTH O & CLAMPED TOOLS AIR LUBR. UNCLAMPED O (LOCK-OUT UAL (7) AUTO OPERATING CONSOLE LOCATED ABOVE THE LOADING STATION OF SECTION A MASTER CONTROLS HEADS FULL CLAMP CLAMP 00 STOP SET 0000 0 00 000 00 0000 Ō 3-13 Ō 00 TOOLS AIR LUBR L DAUTE ON OFF START STOP MASTER CONTROLS C STOP SET 0 0 0 ON 0 0 0 0 0 0 3-10 INDEX HEADS BACK FULL DEPTH UNCLAMPED

The lights are of various colors—red, green, amber, and white—to facilitate observation by the attendant.

When the transfer machine is divided into sections, a console is located at each loading station. Each console contains controls for the section on which it is located, and master controls for all subsequent sections. The controls are broken down into the various stations or groups of stations.

The operating consoles provided on a three-section transfer machine are shown diagrammatically in Fig. 5. As can be seen, the section controls are divided into groups of stations for convenience in locating trouble. When the emergency return button on the consoles is depressed, all heads are immediately retracted.

Lock-out lights (lower right, Fig. 5) are provided for tools, air, and lubrication. When these lights are green, the machine can operate; if red, the machine stops. The tool light is connected to a cycle counter, and flashes red when the tools require changing. Air is used to blow out chips or for inspection purposes, and upon interruption in the supply, this light will turn red. A clogged lubrication line or a build-up in pressure due to lack of lubricant will change the lubrication light to red.

One of the latest innovations in operating consoles is to separate the push-buttons from the indicating lights. The lights are placed at eye level, and the push-buttons and switches convenient to the operator's hands. Such a console is illustrated in Fig. 6. To prevent the surge in the power line that would be required in starting the numerous motors on a transfer machine, a timer is provided to start the motors at short intervals.

Control panels, containing all the relays, contactors, timers, starters, fuses, and wiring from the various machining units and operating consoles, are enclosed in dust-tight cabinets. Hinged doors on these cabinets close on gaskets, and the circuit breaker or line disconnect switch is interlocked with the cabinet handle so that the door can be opened only if the power is shut off. As a safety precaution, control circuits operate on 110 volts rather than on the line voltage of 440 or 550 volts. All control wiring and electrical devices are marked to correspond with a wiring diagram furnished with the machine. For example, numbered adhesive tape labels are

Fig. 5. Operating consoles provided on a three-section transfer machine. Upper console is located above loading station at front of machine, center one above second section, and bottom one on last section.

Fig. 6. On this console, push-buttons and switches have been separated from indicating lights. Lights are placed above—at eye level—while buttons are located below, convenient to operator's hands.

wrapped around both ends of each wire, and corresponding numbers are provided on the terminal blocks to which the wires will subsequently be connected.

Wiring of control panels frequently used to be done with solid wire bent and fitted to lay flat against the panel board, and held in place with straps. This method of "flat" wiring was replaced on many transfer machines by cable wiring. Multiple-strand, flexible plastic covered wire tied in bundles is used, with individual leads peeled off and connected to the various devices. There seems to be a trend now toward a fiber duct method of wiring developed by Snyder which requires no cabling, and simplifies servicing and rewiring.

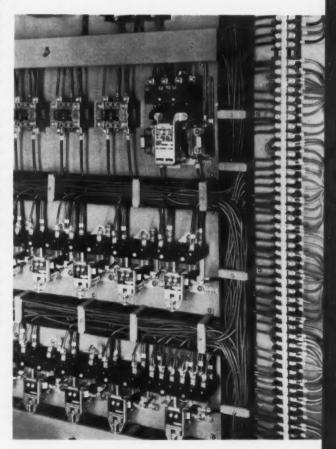
U-shaped channels of fiber are fastened to the panel board above a row of devices, as seen in Fig. 7, with the open faces of the channels facing out. The sides are perforated so that wires laid in the channel can be pulled through, wherever convenient, to connect to the various devices. Junctions between horizontal and vertical runs are made by slotting the side of one channel and fitting the open end of the other to it. When the wiring is complete, covers are fastened over the open face by means of wing nuts on studs protruding from brackets through holes in the fiber duct covers.

J.I.C. standards are adhered to in specifying all electrical and hydraulic equipment. These standards minimize the number of spare parts that must be stored, provide greater accessibility of components to facilitate maintenance, and permit more efficient operation. Also, protection is provided against contamination and operating dangers. For example, sealed reservoirs are provided for the hydraulic oil, while filters and substantial reservoirs assist in maintaining the oil at the proper operating temperature.

Hydraulic pumps, valves, feed controls, filters, and similar equipment are manifold mounted on the outside of the units to facilitate maintenance and replacement. Hydraulic cylinders are provided with self-regulating, wear-resistant seals to minimize leakage.

Fig. 7. Improved method of wiring control panel, in which wires are placed in fiber ducts. The ducts are perforated in order to permit wires to be pulled through for connecting various electrical devices.





Inspection Keeps Pace with Modern Manufacturing Methods

By W. H. VANN, Chief Inspector

Pontiac Motor Division General Motors Corporation Pontiac, Mich.

By extensive use of the latest type automatic handling devices, transfer machines, and other automatic machinery, the Pontiac Motor Division of General Motors Corporation is capable of producing more than 150 Strato-Streak V-8 engines per hour. To keep pace with the high production made possible by automatic handling between operations, and to prevent the manufacture of large quantities of parts that must be scrapped or reworked, many completely automatic gaging and sorting machines are used. In some cases, the inspection equipment is built into or connected to the ends of machines to detect unsatisfactory parts immediately at their source.

One example of a completely automatic, multiple-action gaging and sorting machine is shown in Fig. 1. This unit, made by the Federal Products Corporation, is designed for the 100 per cent inspection of V-8 engine valves, and checks the stem diameter, size and location of retainer grooves, run-out and taper of the stem, over-all length, thickness of the head, concentricity of the seat, and hardness of the valve stem end. Also, the machine is capable of sorting the valves-based on their stem diametersinto any of seven size classifications in addition to either over size or under size. Two identical machines are employed, one for intake valves and the other for exhaust valves, and each machine is capable of gaging and sorting 2400 valves per hour.

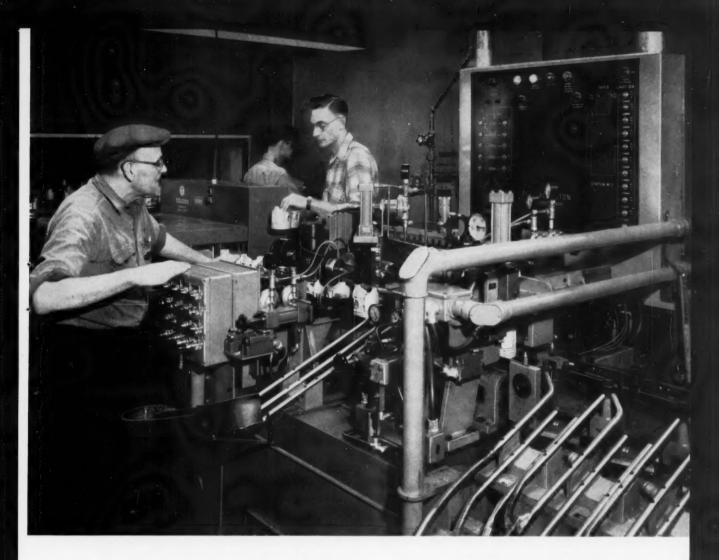
As seen in the close-up view of one of these valve inspection machines, Fig. 2, the valves are picked up singly from a conveyor by a four-

station turret head. The turret head turns each valve upside down to position the stem end under the scleroscope tube, and holds the valve during the hardness check. The stem ends are induction-hardened to a depth of 1/16 inch, and must have a minimum scleroscope hardness of 52. This is checked by the light beam from a photo-relay unit. If the diamond-tipped hammer that falls in the scleroscope tube does not rebound high enough to interrupt the light beam, the part is too soft and is automatically rejected.

Satisfactory parts are again turned over as they are returned and unclamped by the turret head. The valves, positioned with their head ends up, are carried by conveyor to the various gaging heads. These heads are of the electromechanical type, having movable coils attached to their spindles and two fixed coils fastened to the gage-head casting. Movement of the spindle, caused by any change in the size of the workpiece, shifts the relative positions of the spindle coils to the fixed coils. The electrical circuits thus set up control the disposable traps for unsatisfactory parts.

In checking the run-out of the valve stems, the valves are rotated by means of a friction wheel riding on the valve. Maximum and minimum diameters of the valve stems are determined at this same checking station, and the readings are converted into electrical impulses which are fed into a differential classifier. The classifier actuates solenoid-operated trap doors, with the proper door opening for each part to fall into its correct size chute.

Taper of the stem is checked by having a gage:



head contact points at both the front and rear of the stem. The gage-head reading is determined by the difference between the two diameter readings. Pantograph units are provided with each gage head to absorb back-and-forth motions of the valves, thus minimizing side thrust on the gage-head spindles.

Valve push-rods, made from formed steel tubes approximately $9\,5/16$ inches long and 5/16 inch in diameter (purchased from outside suppliers), are 100 per cent inspected prior to assembly in the engine on the Federal automatic gage seen in Fig. 3. This unit checks the rods for over-all length, diameter, the presence of oilholes, straightness, and hardness. Inspection can be performed automatically at the rate of 3600 per hour.

Rods are dumped into a hopper, from which they drop, one at a time, into a feed chute. From the chute, each rod falls into notches on a rotating drum, Fig. 4, and is carried past the various gaging heads. Thus, inspection is simplified by dividing the various operations among several stations. This machine is equipped with Federal Electricator heads, which are simple measuring

devices of the electrical contact or switch type. A change in the size of the work-piece moves the gaging spindle, which actuates switches to set up the necessary electrical circuits for accepting or rejecting the rods.

In checking straightness, the valve push-rods are rotated by means of motor-driven, spring-loaded drivers which contact the spherical ends of the rods while a gaging spindle contacts their centers. The presence of required small oil-holes in the ends of the rods is insured by introducing electrical contact probing pins. To prevent the use of soft push-rods in the V-8 engines, their hardness is checked electrically by means of an unbalanced circuit. Work-pieces are not sorted as to the reason for being rejected, but simply fall into either of two receptacles—one for acceptable parts and one for rejects.

Valve rocker arms and valve rocker arm balls, which are both stamped from S. A. E. 1010 hotrolled steel strip stock in progressive dies, are
checked automatically on Arlin electronic inspection units such as the one seen in Fig. 5.
Balls are dumped into a rotary barrel type of
hopper unit which feeds the parts to the gaging

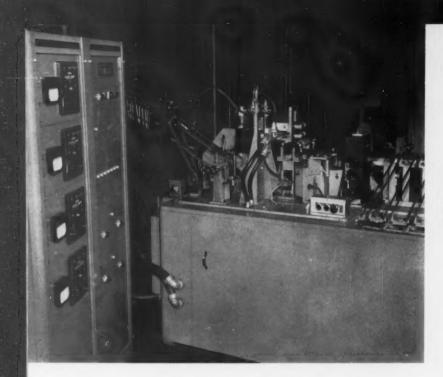


Fig. 1. V-8 engine valves are inspected and sorted into seven size classifications on this automatic unit. Scleroscope hardness of valve stem ends is also checked in this automatic operation.

heads for checking their outside diameters, out-of-roundness and size of the central stud holes, alignment of these two holes, and the presence of oil-grooves in the bases of the balls. In inspecting the valve rocker arms, the distance from the flat valve contact face to the spherical rocker arm ball seat, as well as the distance from the spherical push-rod seat to the spherical rocker arm ball seat, is checked while the part is subjected to a 50-pound load. Also, the squareness of the rocker arm face with relation to the center line of the arm is checked.

The gaging heads on both of these inspection machines employ high-frequency, radar type, reflected wave circuits. Heads are set up by means of vernier adjustment screws, with a master part set in cycling position on the machine. Then, the master is removed and tuning cables are connected for final adjustment of each gaging head.

An interesting example of built-in automatic gaging for direct control is on pairs of Lo-swing lathes used to completely turn and chamfer bearing surfaces on the V-8 engine camshafts. Automatic equipment has been provided for loading and unloading both lathes in each pair, transferring the shafts between lathes, and inspecting the machined surfaces. At the completion of the cycle on each lathe, the shafts are elevated into a sizing control station, Fig. 6, where specially designed snap gages check the turned bearing surfaces. Two bearing surfaces are turned and inspected on the first lathe, and three on the second machine.

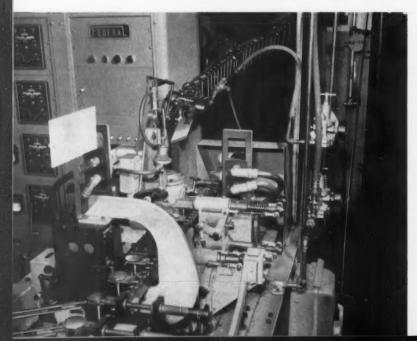
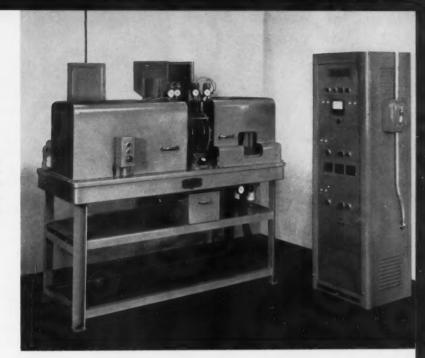


Fig. 2. Close-up view of the inspection machine seen in Fig. 1. Four-station turret head picks up valves, turns them upside down, and positions them under hardness test unit.

Fig. 3. Over-all length, diameter, presence of oil-holes, straightness, and hardness of valve pushrods are checked automatically at the rate of 3600 per hour on this hopper-fed machine.



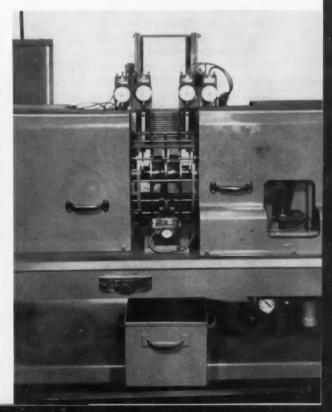
Incorporated in the basic design of the camshaft lathes are automatic sizing gages, each containing a Sheffield Electrichek head. These heads mechanically amplify dimensional changes in the turned bearing surfaces. When a part having over- or under-size bearing surfaces is produced, the gage head produces electrical signals that stop the lathe. Signal lights indicate which surface is out of tolerance and whether the high or low limit has been exceeded, so that the operator can adjust or replace the tools to correct the trouble. This shaft must be removed manually from the gaging station before the following camshaft can be indexed into cutting position. Work-pieces passing inspection on the first lathe are automatically transferred to the second lathe. The camshafts passing inspection on the second lathe are automatically unloaded.

Another application of automatic built-in sizing controls is on a Greenlee thirteen-station transfer machine for chamfering, boring, and reaming connecting-rod and cap assemblies for the V-8 engines. Eight assemblies are indexed at a time to each successive station. At the seventh station, Fig. 7, a Sheffield automatic inspection unit has been built into the machine for checking the diameters of the pin-holes, which have been finish-reamed at previous stations. This is necessary to insure the proper press fit of split bushings which are automatically fed from hoppers and pressed into the pin-holes of the assemblies at the ninth station.

Fig. 4. Notched rotating drum carries valve push-rods from hopper-jed chute past the various gaging heads. The rods automatically fall into either of two receptacles.

The sizing control set-up consists of eight air spindles connected pneumatically to an equal number of Sheffield Airlectric heads. The sensitive pressure switches in these heads illuminate signal lamps which show when the pin-hole diameters are nearing over or under size. Thus, an operator can adjust or replace the cutting tools before unsatisfactory work-pieces are produced. Rods having under- or over-size pin-holes are automatically ejected at the eighth station of this transfer machine.

Gaging dials are also provided on this auto-



MACHINERY, March, 1955-165



Fig. 5. Electronic inspection machine of the type employed to automatically check both valve rocker arms and valve rocker arm balls, which are sheet-metal stampings

matic inspection unit to permit the operator to see the exact pin-hole diameter being produced. Air blasts from the gaging air spindles help to remove chips from the holes. Also, the gaging spindles are spring-loaded so that they will retract in case they encounter a broken tool or a hole too small for the spindle to enter.

Final inspection and sorting of the connectingrod assemblies are accomplished on the Sheffield machine seen in Fig. 8. Completed assemblies from the connecting-rod manufacturing line are carried to the automatic, two-station inspection machine on a conveyor belt, and are then indexed from station to station by means of a shuttle type transfer bar. The machine checks the crankhole diameter having a tolerance of 0.0005 inch, the pin-hole diameter having a tolerance of 0.0004 inch, and the center distance between these two holes having a tolerance of 0.002 inch. Also, the angularity of the two bores with relation to each other is checked. Reject rods are separated from satisfactory assemblies, and the latter are sorted and color coded into any of four size classifications, successive classifications varying from each other by only 0.0001 inch in piston pin-hole diameters.

This machine makes use of Sheffield Lectrolair control units which energize signal lights

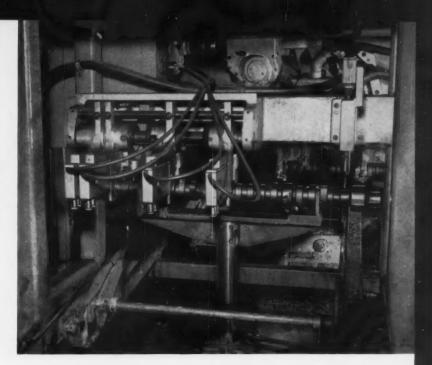
and relays. These units have limit type pneumatic gage heads, and are provided with pneumatic dial indicators for setting up the machine and direct reading of the bore sizes. Also, Sheffield differential gage heads are used to pneumatically gage the center distance between holes and the relative angularity of the two bores. These heads convert differences in air pressures in the gaging circuit into electrical impulses that are used to energize signal lights and relays. A continuous belt at the end of the inspection machine is equipped with swinging arms (operated by electrical relay) which sweep each connecting-rod assembly from the conveyor belt into the correct chute for its pin-hole size classification. As the assembly slides down the chute, the proper color is applied for coding the part. This machine is capable of inspecting and sorting 1700 connecting-rod assemblies per hour.

Automatic inspection is very much in evidence on the piston production line for the V-8 engines, where gaging units are used at frequent intervals to prevent rejected parts from continuing through subsequent machines. This is essential to attain the required production from the completely automatic line, which is rated at 2000 pistons per hour. One such qualifying unit inspects the pistons after practically all machineing has been completed on Hoern & Dilts rotary indexing machines and Acme-Gridley multiplespindle automatics, prior to entering Buhr drilling machines.

This completely automatic, two-station Sheffield gaging machine is conveyor fed from the automatics, and has an air-operated transfer bar for moving the pistons from station to station. Airlectric gage heads, having limit type pneumatic control units for actuating signal lights and relays by making or breaking electric contacts, are employed to check ring groove widths and diameters, ring land diameters, and turned skirt diameters. Also, carbide fingers are used to inspect a minimum width at the bottom of the grooves. If a piston is produced with groove widths less than this minimum, a signal light will indicate breakdown of the grooving tools. Such tool breakdown causes excessive fillets at the bottom of the ring grooves. Pistons satisfying the various inspections are automatically loaded on a conveyor leading to the oil-hole drilling machines.

Automatic inspection units are also provided in the piston production line for checking the parts after drilling and elliptical skirt grinding. In the gage for the first application, probes enter the holes to insure that they have been drilled and are properly located. Absence of any hole, holes not drilled through, the presence of

Fig. 6. Special snap gages having Electrichek heads are built into camshaft lathes for checking turned bearing surfaces. When shaft does not pass inspection, lathe automatically stops.



broken drills, or improperly located holes cause automatic rejection of the piston from the production line.

Final inspection of the pistons is automatically performed on the Sheffield gage seen in Fig. 9, which is located in an air-conditioned room having the temperature constantly controlled at 70 degrees F. Pistons are carried through a temperature normalizing tunnel on a conveyor to the two-station gage in the air-conditioned room. At the first station, Lectrolair control units and Airlectric gage heads check the piston pin-hole sizes, classify them into four groups (each successive size classification varying from the preceding one by only 0.0001 inch difference in pin-hole diameter), and automatically stamp an identifying size classification number on the

piston head. Pistons having over- or under-size pin-holes are automatically ejected.

After being moved to the second station by an air-operated push-bar, the skirt diameter and taper of the piston are checked. To measure the diameter, work contact points on pairs of pivoted arms are spread apart to actuate the gage heads. Memory circuits are automatically set up for subsequent sorting of the pistons into any of eight size classifications (each size group varying from the preceding one by 0.00025-inch difference in skirt diameter). The pistons are automatically stamped with an identifying letter which corresponds to the cylinder bore stamping placed on the engine blocks when they are inspected.

A Sheffield differential gage head is used for

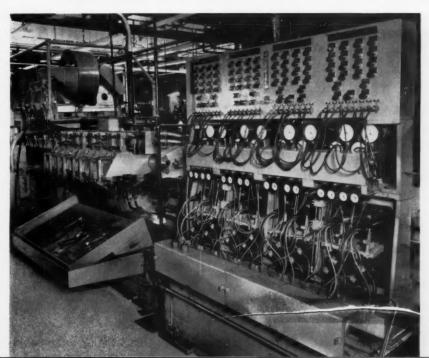
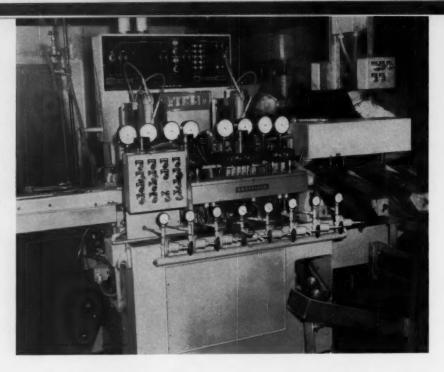


Fig. 7. Automatic inspection unit built into the seventh station of a transfer machine for checking the diameters of pinholes in connecting-rod and cap assemblies. Eight assemblies are checked at a time.

MACHINERY, March, 1955-167

Fig. 8. Crank holes, pin-holes, center distance between holes, and angularity of bores are checked, and connecting-rod assemblies are sorted into four pin-hole size groups on this automatic unit



pneumatically gaging the taper of the piston, converting differences in the air pressure of the gaging circuit into electrical impulses. As the pistons leave the inspection machine on conveyor belts, electrically controlled swing gates actuated by the pre-set memory circuit direct the pistons into different chutes depending on their skirt diameters. From these chutes, the pistons drop to other conveyor belts which carry them out of the temperature-controlled room and to storage racks. The pistons are stored according to their skirt diameter classification, and are matched with sorted piston-pins when they are removed for assembly.

Piston-pin checking and sorting are performed automatically on the Federal gage seen in Fig. 10. The pins are inspected after having

been carburized to obtain a case 0.035 inch deep, centerless ground, and washed. A conveyor carries the pins from the washer to the gage, where they are picked up one at a time by a notched rotating wheel. At the first station, Electricator measuring devices check the over-all length of the pins, and a scleroscope unit is employed to insure that their minimum surface hardness is 78. Pins are then dumped into a rejection chute or transferred to a shuttle bar.

At subsequent stations, gage heads similar to those used for inspecting the engine valves are employed to check the diameter, out-of-roundness, and taper of the pins. The out-of-roundness is held to 0.0001-inch total indicator reading, maximum taper is held within 0.0001 inch in the full length of the pins, and their

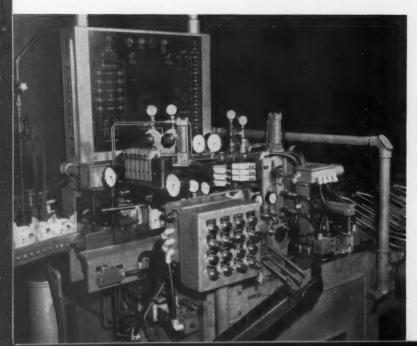


Fig. 9. Final inspection and sorting of the pistons according to their skirt diameters are done in a room having the air temperature-controlled at 70 degrees F.

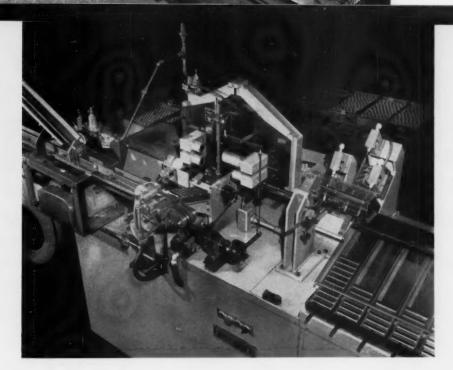


Fig. 10. Piston-pins are checked and sorted automatically at the rate of 3600 per hour on this unit. A scleroscope hardness test is included in the inspection.

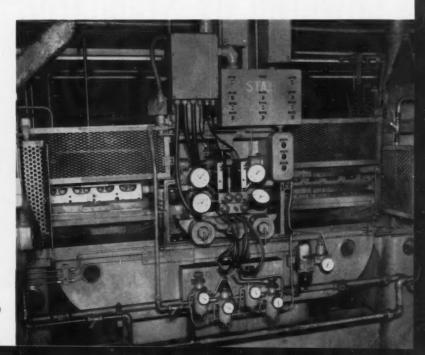
diameters are held to a total tolerance of 0.0004 inch. Pins leaving the inspection machine are dumped into one of seven disposal chutes by a memory unit controlled by the preceding gaging operations. Unsatisfactory pins enter one of the first three chutes, depending on whether they have excessive taper, have too much out-of-roundness, or are under or over size.

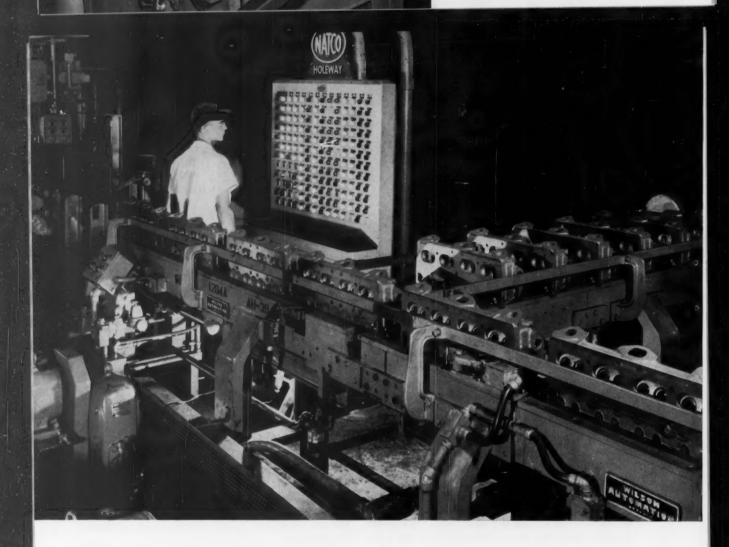
Satisfactory piston-pins are classified by being deposited into one of the next four chutes—the pins entering one chute differing from those entering the next by only 0.0001 inch in their diameters. This completely automatic inspection unit has a variable-speed control which is capable of completing 4000 pins per hour but is presently set for 3600 per hour to match the output from the centerless grinding machines.

Typical of the numerous gaging units built into the many transfer machines used in the V-8 engine block and head production lines is the one shown in Fig. 11. This 100 per cent production inspection gage is located on a Natco transfer machine used for the cylinder heads. The gage checks the inside diameter of two holes, 1/2 inch in diameter, which have previously been drilled and reamed for locating purposes. Also, the center distance between these two holes is inspected.

If the holes are over or under size, improperly located, not drilled, or a broken tool is present in either hole, a red signal light flashes on the control board of the transfer machine. Then, the production personnel can take corrective action immediately.

Fig. 11. Size and position of two locating holes in V-8 engine cylinder heads are checked with this gaging unit built into a multiple-station transfer machine.





Automation Costs Lowered by Standardization

By E. B. WILSON, President Wilson Automation Co. Detroit, Mich.

Standardization of automation units such as loading, transferring, turnover, turnaround, positioning, and unloading devices has permitted rapid and more economical production applications in small as well as large metal-working plants.

UTOMATION can be applied to small and medium-size factories as well as to large mass-production plants. Pioneering in the use of automation devices has been done by the automotive industry, where the production of large quantities of identical parts makes the investment economically feasible. However, conservation of manpower and reduction in labor costs should be the principal factors in justifying the cost of automation. For these reasons, many smaller shops are turning to automation in order to meet the demands of the highly competitive market of today.

Use of automation devices in smaller shops has been made possible in many cases by the reduction in their cost through standardization and use by the automotive industry. While guide and work-supporting members of loading, transferring, turnover, turnaround, positioning, and unloading devices must be tailor-made to fit a particular part, many components can be inter-

changeable.

In addition to the cost savings of standardized automation equipment, the installation and maintenance of such units are greatly simplified. Also, flexibility is of major importance when production must be changed frequently from one work-piece to another. Standard automation devices can be quickly disconnected from one machine and installed on another, or repositioned in a production line to suit requirements.

A standard transfer unit developed by the Wilson Automation Co. is shown in Figs. 1 and 2. The units contain a sliding saddle A actuated through a twin-guide "binocular" driving mechanism B by means of an air or hydraulic cylinder C. Rectangular transfer bars D, secured to saddle A, are supported by—and travel on—rollers E. Dogs F push the work-pieces along slides G,

which are secured by screws to the tops of side members H. The side members are mounted the required distance apart by means of a tie-plate J.

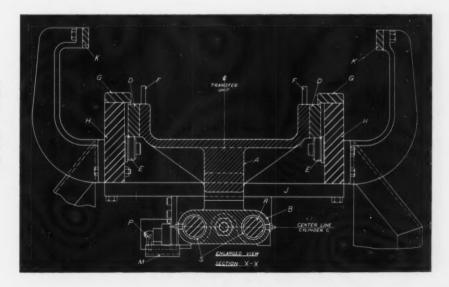
Side rails K secured to brackets guide the work-pieces as they are transferred along slides G. Splice plates L are provided at both ends for joining the transfer device to similar units, or to the loading or unloading end of a machine. The transfer units are mounted on channel iron legs having adjustable feet for raising or lowering the height at which the parts are transferred.

The distance that the work-pieces are transferred per indexing is also adjustable, being controlled by the positions of cams M and N which are secured by screws to the under side of the binocular mechanism B. When cam N contacts limit switch O, the direction of the cylinder piston is reversed, and the transfer mechanism returns to its starting position as shown. As cam M contacts limit switch P, movement of the cylinder piston is automatically stopped until the next cycle begins. Pusher dogs F are of the counterbalanced type; weighted ends bring them into the positions shown (against stop-pins Q) for advancing the parts. The dogs are pivoted downward, below the top surfaces of slides G, by contact with the work-pieces on the return stroke of the cylinder piston.

As shown in enlarged section X-X, Fig. 1, the binocular driving mechanism (carrying the saddle, transfer bars, and pusher dogs) travels on guide shafts R, which are mounted in powdered metal bushings S. Powdered metal bushings are also used for the pivoting shafts of dogs F, and the bearings for rollers E.

Standard transfer units such as the one shown are made 90 inches long. Bolted and keyed construction is used throughout, and members (including the splice plates) are drilled in jigs to

Fig. 1. Enlarged view of cross-section X-X through the standard transfer unit shown in Fig. 2 illustrates the shafts (R) which carry the binocular driving mechanism.



insure accurate alignment and interchangeability. This design facilitates fitting adjoining units together and simplifies maintenance. While the unit illustrated was designed for the broadside transfer of V-8 engine cylinder blocks, most members of the device can be used for lengthwise transfer of the same or similar parts. All that is necessary is to substitute a shorter tie-plate, and possibly different slides, side guide brackets, or saddle—depending upon the work dimensions.

The low-pressure cylinders used for actuating all standard transfer units are identical-with the exception of length of stroke-regardless of whether air or hydraulic fluid is used as the medium. Selection of air or hydraulics for operation depends upon customer preference. While air-operated units represent a lower initial investment, their operating costs are generally higher unless surplus compressed air capacity is available in the customer's plant. Where cost is not a major factor, the Wilson Automation Co. prefers to supply hydraulically operated units. Cylinders are conventional with the exceptions that the ports on their rod ends are located 90 degrees from standard, and both ends of the cylinders are cushioned.

At one of the most modern automotive engine manufacturing plants, numerous standard automation transfer units are employed to tie together all of the machining, cleaning, and inspection machines required in processing cylinder block castings. In this way, a total of 170 operations are performed in one completely closed line. These transfer units are air actuated.

Cylinder block castings weighing approximately 200 pounds first pass progressively through three Ingersoll multiple-station transfer machines. After leaving the third machine, the engine blocks are transferred at an angle of 90 degrees to their previous direction of travel, prior to entering either of two lines each containing three Greenlee multiple-station transfer machines. At this point, an automatic turntable rotates the blocks 90 degrees in a horizontal plane; a standard turnover unit turns the blocks over 180 degrees in a vertical plane; and a standard side loader feeds them into the transfer machines. A turnover fixture, seen in Fig. 3, is built into the Greenlee transfer machines for turning the blocks through 180 degrees in a vertical plane. The blocks enter the fixture with their pan rail faces up, and are positioned with the cylinder face up for subsequent machining.

Typical of the standard 90-degree automatic turntables made by Wilson is the one shown in Fig. 4. Work-pieces are fed into the turntable one at a time from a standard transfer unit, moving along slides A and guided by side rails B. The guide rails are supported at the required transfer height by riser-blocks C, which in turn are mounted on turntable D. A central shaft E, mounted in taper roller bearings, is supported by base casting F and legs with adjustable feet.

While sliding into position, the work-piece depresses a spring-loaded, mushroom-headed plunger G. Lowering of this plunger causes contact with a limit switch H, which actuates cylinder J. Attached to the piston-rod of this cylinder

Fig. 2. Standard unit for the broadside transfer of engine blocks. Dogs (F), work-pieces along slides (G). An end view is seen at right and enlarged

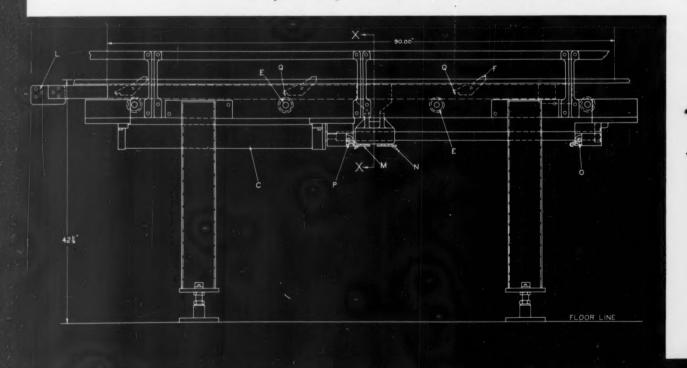
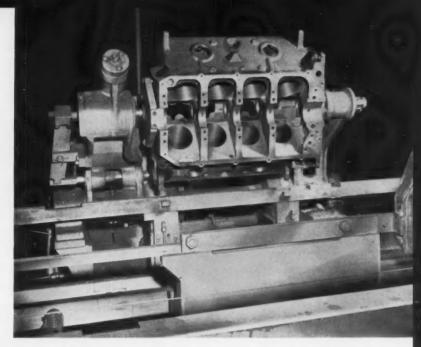


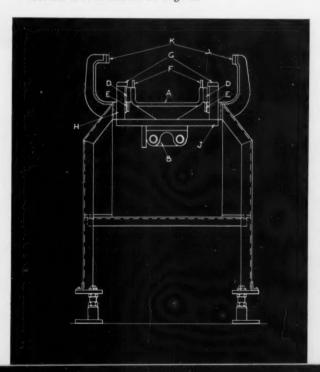
Fig. 3. Turnover fixture built into transfer machine for rotating the V-8 engine blocks through 180-degrees in a vertical plane to position the cylinder faces up for subsequent machining operations.



is a rack K in mesh with a pinion L for rotating the table. When the table has rotated the required 90 degrees, the lower end of plunger G contacts limit switch M, which renders the cylinder inoperative and stops the table rotation. When the work-piece has been unloaded from the turntable—usually by means of an automatic side thrust loading device—the cylinder returns the table to its starting position. For 180-degree rotation of the work-piece, a cylinder having twice the length of stroke would be substituted, and limit switch M would be moved to a position 180 degrees from switch H.

The set-up for loading blocks into the cylinder-

actuated by cylinder (C), push section X-X is shown in Fig. 1.



bore honing machines is shown in Fig. 5. Here the castings are changed from a broadside transfer position to a lengthwise position by means of a standard 90-degree automatic turntable, and then fed by a side-thrust loading device.

At this point, the blocks are selectively fed into any one of three honing machines. This arrangement, also employed at other locations in the line, permits coordination of machines having unequal productive capacity. In some cases only one machine is required to attain the necessary production, while in other instances as many as four identical machines are needed. By electrically interlocking the standard automation devices, all machines are connected in one integrated production line.

After honing the eight cylinder bores in each block on the eight-spindle honing machines, the blocks are automatically tipped up on end. A swinging transfer arm, located between a pair of single-spindle honing machines used to finish the crank bearings, picks up the blocks and alternately loads one, then the other machine. A similar arm, Fig. 6, alternately unloads these machines and transfers them to a Sheffield bearing and bore inspection unit.

Another typical combination of standard automation units employed in processing the engine cylinder block is seen in Fig. 7. This set-up contains a standard lengthwise transfer unit (seen at the rear right), two standard side-thrust loaders, and—between the loaders—a broadside transfer unit consisting of two standard 90-inch long units. The installation is used to automatically transfer blocks from a washing machine into either of two finish-boring machines.

By means of the various automation units, the engine blocks are placed into six different posi-

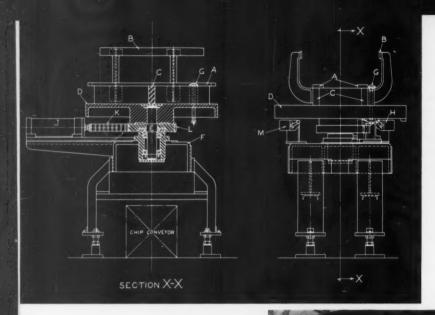


Fig. 4. (Left) A standard turntable in which work-piece depresses plunger (G), thus actuating cylinder (J) for rotating table (D) by means of rack (K) and pinion (L).

Fig. 5. (Right) Cast engine blocks entering the cylinderbore honing machines are changed from a broadside to a lengthwise position and fed by means of a side-thrust loading device.

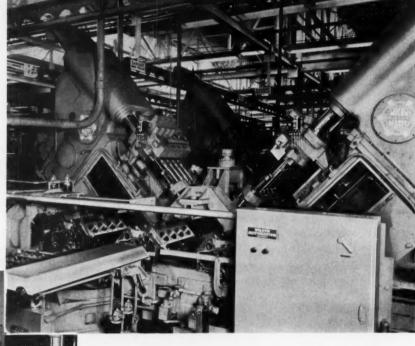


Fig. 6. (Left) Swinging transfer arm alternately unloads pair of crank bearing honing machines and carries V-8 engine blocks to bearing and bore inspection unit.

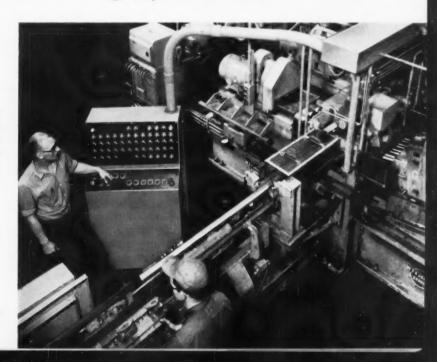


Fig. 7. Lengthwise and broadside transfer units and two side loaders are combined in this installation for moving blocks from a washer to either of two finish-boring machines.

tions as they are transferred along the production line, and the blocks have to be handled manually only twice during the entire processing. Many idle stations are provided within the transfer machines, and spaces (connected by standard transfer units to form a continuous line) are left between adjacent machines either to provide for future changes in engine block design, or for production increases. Also, this set-up permits segmented automation, in which blocks can be removed at various points along the line for storing. Thus, portions of the line can be kept in production while others are idle for maintenance, tool changes, or other reasons.

The cylinder head production line for the same V-8 engine, in which one hundred operations are performed on each casting, is also automated to a high degree. The heading illustration shows some of the standard transfer units employed in moving heads from Cincinnati broaching machines to Natco multiple-station transfer machines. Also, the transfer units for carrying the heads into the loading station of a W. F. & John Barnes multiple-station transfer machine are seen at the lower left in Fig. 8. In this machine, 8 holes are drilled, 32 are reamed, 8 are spotfaced, 8 are burnished, and 8 valve guide bushings are pressed into each head.

Fig. 8. Standard transfer unit (seen at lower left) is used to carry V-8 engine cylinder heads into loading station of a multiplestation transfer machine.





Electrical Requirements of a Typical Transfer Machine

By JOHN W. HARPER Metalworking Engineering Industrial Engineering Section General Electric Co. Schenectady, N. Y.

The field of repetitive manufacture has for a long time been familiar with special automatic machines that turn out a given part or perform a specific operation at high production rates. These machines in themselves, however, do not meet modern requirements for continuous automatic production. It is only when special machines, or modifications of standard machines, are combined with suitable means for transporting the work through and between the machine units that factories can attain the ultimate goal of a continuous flow of parts, rather than with batch manufacturing.

Carrying this idea further, inspection, assembly, testing, and packaging can all be considered as being within the ultimate objective of continuous automatic production—adjuncts to the actual manufacturing. These functions have already been provided in some transfer type equipment.

Continuous automatic production, or automation, is based on more pieces per unit time than under former practice. As a result, for a given job, driving motors may be loaded more continuously or even larger motors may be needed.

This does not necessarily mean more energy consumed per piece, because of the greater number of pieces produced.

Additional horsepower is needed to take care of the materials-handling aspect of automation. This may be provided by motors for driving pumps that supply hydraulic power for many of the relatively short motions. It may also be obtained through adjustable-voltage, direct-current drives used for certain feed functions—such as may be required for milling machine tables. Additional power is also needed for the solenoid valves necessary for the hydraulic circuits.

For controlling all operations of a transfer type machine in the desired sequence, a multiplicity of limit switches, push-buttons, indicating lights, and various types of relays is required. Relays may be of the ordinary variety, or they may be of a design that prevents improper "sequencing" if power fails. They may incorporate a timing feature. Photo-electric devices may fit in best for certain types of interlocking in which mechanically operated limit switches may not be feasible.

Position and load control can be provided by limit switches or electronic devices. Tracer control can be supplied for individual machines when special shapes are to be machined. The requirements of the over-all problem determine the specific features to be used. Automatic gaging and inspection devices are incorporated in fully automated equipment.

A recently installed transfer type machine having thirty-seven stations consists of five milling machine units for automatically rough- and finish-milling the faces of automotive transmission cases. Between the roughing and finishing stations are drilling and tapping units. The electrical components and the operation of the milling portion of this line will now be considered.

The transmission cases are automatically moved from one station to the next in a sequence controlled by limit switches, solenoid valves, and relays. At certain stations, the piece is merely moved onward, and at others it is turned around, or rolled over, as necessary for the machining sequence. The over-all relationship of the various units and stations is indicated in Fig. 1.

Normally, the milling cutters run continuously. The transmission case is deposited on the milling table of the first machine unit by the transfer mechanism and then locked in place. An adjustable-voltage drive, actuated by a 3-H.P. motor operating at 150 to 1200 R.P.M., moves the piece past the milling cutters. Rapid acceleration and deceleration provide the required cycle. After rough-milling is completed, the piece is picked off the table, and the latter returns to the starting point at high speed to receive the next transmission case.

Twenty-nine motors ranging in size from 1/4 to 75 H.P. are required for the milling units in addition to the five generators supplied for the feed drives. Except for the motor-generator sets and 1/4-H.P. gear-motors for the lubrication pumps, they are totally-enclosed and fan-cooled.

Each of the machine units requires a control panel to provide for the starting of its motors as well as for the relaying and interlocking necessary to meet the conditions of the operating cycle. Each unit controller is located in a NEMA-12 floor type enclosure. The starters for the unit, as well as for the motor-generator set for the feed, are located on one side of the panel, while the relaying circuits are on the opposite side. Features provided by each controller include:

- Main alternating-current disconnect interlocked with all doors.
- Disconnect for lighting circuit (not interlocked).
- Fluorescent lights that go on when doors are opened.

- Convenient outlet (110-volt) that is available with the enclosure door open and the main disconnect closed.
- 5. Full-voltage starters for all alternatingcurrent motors in the unit, sequenced so that a maximum of 75 H.P. can be started at any one time.
- Reversing drive for feed motor that provides a jog and traverse speeds in each direction, with a slowdown from limit switches to permit accurate stopping.
- 7. Motor-generator set inside the enclosure for supplying power to the feed motor.
- Disconnects and starters (including feed motor control) front-connected on one base.
- Interlocking relays (110-volt) mounted on a base back to back with power devices and front-connected.
- Vertical terminal boards at sides. Outgoing leads at top to duct work supplied by machine builder.
- 11. Indication of overload tripping.
- 12. Trough wiring.

The five control panels are located opposite their respective units along the right-hand side of the machine facing the loading end. The side of the panels having the interlocking relays faces the machine line.

Coordinated operation required for the various stations of the machine is covered by cycle diagrams submitted by the machine builder. The various stations are interlocked so that each operation must be completed before the next can start. All functions of the machine must have been performed in the proper sequence, and all moving parts brought back to the starting point, before the next automatic cycle can be started.

To meet all these requirements, approximately 190 limit switches and 140 solenoids are provided on the machine referred to. In addition, 425 relays of various types (including photo-electric) transmit signals from the limit switches to the solenoids and other devices.

Push-buttons are provided for normal operation under the different operating conditions, as well as indicating lights that show the location of trouble. There are approximately 180 momentary contact push-buttons, 170 indicating lights, and 16 selector switches distributed among three panels at each unit. The master panel has lights for each of the subsequent units, including the drilling and finish-boring units. It also has buttons to start the automatic cycle, with lights to indicate (1) when it is permissible to pre-set an automatic cycle; (2) when the cycle is pre-set; and (3) when the machine is actually operating automatically. Other buttons provide for cancel-

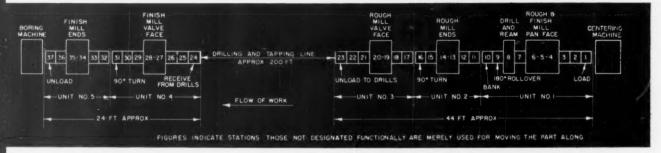


Fig. 1. Diagram of a typical transfer type machine that handles automobile transmission cases, showing relationship of rough- and finish-milling units

ing a pre-set and stopping the individual units if necessary.

Only the lights on the master panel indicate unit malfunctioning. Push-button pendants for the individual units have lights which are used in checking the operation of the individual stations. The pendants also have buttons to operate each station manually and lights to indicate extremes of travel as, for instance, the position of clamps. The pendants are normally located on the right-hand, or operating, side of the machine. For convenience when changing tools, they can be swung to the left-hand side of the machine.

The manual panel has a three-position Auto-Manual-Off selector. Start-stop push-buttons control all unit motors simultaneously when the selector is set for automatic operation. Upon setting for manual operation, another group of start-stop buttons controls the individual motors. An additional push-button panel at each unit makes it possible to signal the operator at the head of the line that a piece has been removed and that it is permissible to initiate a new cycle.

Three operating conditions must be established to insure satisfactory performance of automation machinery:

- Automatic operation in which permissive signals must be received from succeeding and preceding stations before the workpieces can advance along the line and a new part can be accepted.
- 2. Completely manual operation for use during set-up and maintenance.
- Provision for by-passing a given machine unit, or units, and automatically operating the rest of the line, both ahead of and behind the by-passed units.

If the line is set for automatic operation, the initial starting of the machine is accomplished by the operator walking down the entire line and starting each individual unit by pressing the unit start-button on the manual push-button panel of each unit. This button will start all the motors of the individual unit (hydraulic pump, spindle, table drive, generator set, and lubrication).

When the entire line has been started so far as motors and pumps are concerned, the operator can begin the first automatic cycle by loading the initial milling station and pressing the cycle preset button at the head of the line. Pressing this button raises the loader. If all the limit switches in the line are properly actuated, the automatic cycle will start as soon as the switch indicating "loader up" is tripped. To start another automatic cycle, the operator must reload the loader and press the pre-set button.

When the line is to be operated under set-up or banking conditions, the Auto-Manual-Off switch

Fig. 2. Starter side of panel for Unit No. 4 of the transfer machine, showing the speed variator for the motor-generator

located on the manual push-button panel of each milling unit is turned to Off or to Manual. A push-button is then brought into the circuit ahead of, and following, the unit affected. The button ahead of the unit is used by the man who is manually banking the preceding unit. He must unload the transmission case and press this button before the operator of that unit can start a new cycle. The button following the inoperative unit is to be used for starting the succeeding units after manual loading from the bank. Depressing this button will turn on an amber light on this station, which indicates that the cycle is pre-set. It stays on until the cycle starts. This button and light are on the master push-button panel for the particular unit.

Turning the selector switch to Manual from Automatic allows a cycle in progress to be completed and then to stop with all motors operating. The machine can then only be operated through a cycle or partial cycle by manual operation of the push-buttons for each station. To start a unit initially with the selector switch at Manual, it is necessary to start each motor in the unit individually. The function of the individual motor start-and-stop buttons in the circuit is taken over by one start-button when the selector switch is at Automatic.

For emergency stopping of the entire line, there is a five-section cord which stops the line immediately and turns on a light to indicate at which unit the cord was pulled. If this cord is pulled during an operating cycle, the entire line must be restarted and reset manually before another automatic cycle can be actuated.

Each unit has an emergency mushroom type stop-button on both the unit master and manual controllers. Depressing this button de-energizes the unit immediately, but other units will continue on their cycle as far as they can do so without a signal from the de-energized unit. In addition to the emergency stop-button, stopping of a unit can be accomplished by turning the selector switch of the unit to Off, but the unit will complete any cycle previously started and then stop with all the elements of each station in their proper position for starting the next cycle.

Checking the line for the location of an inoperative unit during an automatic cycle can be accomplished by a visual check of the lights provided at the head of the line. A light supplied on each milling unit will show green when all elements in that unit are properly positioned. If the line will not function, a check of the lights will

Fig. 3. Relay side of panel for Unit No. 4, illustrating the trough wiring that is provided on equipment of this type

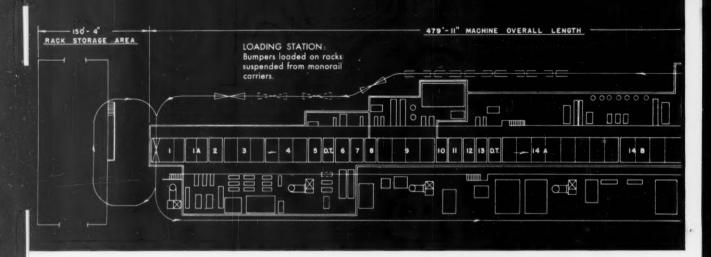
inform the operator which unit is not ready to function. He can then go to that unit and check the lights on the unit panels. Any station can be properly positioned by switching to Manual and correcting the trouble. There is a selector switch for turning off the lights when they are not needed. Depressing the pre-set cycle button of the loader turns on an amber light which indicates that the cycle is pre-set. The light stays on until the new cycle starts.

As a safeguard, a cycle duration timer is provided. This timer is initiated at the start of each cycle. It is set slightly longer than the normal over-all cycle time. If a cycle is not completed within this period of time, the machine will stop and a pre-set will be canceled.

Continuous automatic production as applied to a single component of an over-all product is exemplified in the transfer line just described. The work, once having been put in the loading station, is continuously and automatically moved from station to station. When the end of the line is reached, all machining has been done and the transmission case is ready to receive its internal parts. It is conceivable that these parts, produced on other transfer lines in some future development, may be automatically assembled into the transmission cases so that the complete assembly can move on as a still larger unit.

The electrical components are a major factor in the successful operation of transfer type equipment. Without them, it would be impossible to transmit signals simply and permit modification of manufacturing with minimum disruption.





Automatic Control Permits Plating Cell Selection

More uniform plating of Pontiac wrap-around bumpers is being obtained at lower cost by means of a 480-foot long, straight-line, automatic plating machine. Tanks of various lengths are divided into cells that are automtically selected in sequence according to the length of submerged time.

By T. J. DOYLE, Plating Superintendent Pontiac Motor Division General Motors Corporation Pontiac, Mich.

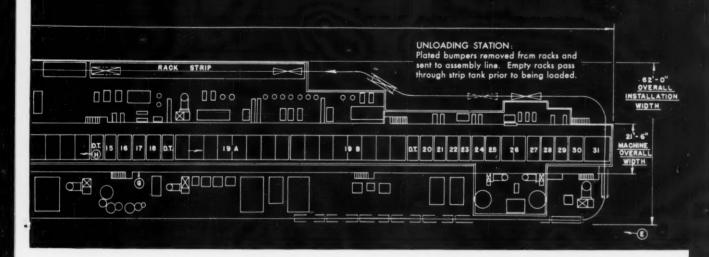
Intricate contours on the wrap-around bumpers used on the latest model automobiles have complicated the problems of plating such parts successfully and economically. The relatively simple, slightly bowed shape of earlier model bumpers made it feasible to plate them in conventional straight-line automatic machines, with the work-carrier entering one end of the plating tank and traveling between rows of anodes to emerge from the plating bath at the opposite end.

The intricacy and sweeping curved ends of modern bumpers made such a method unsatisfactory. With straight rows of anodes, it was practically impossible to obtain the minimum plating thickness required in recesses and on the curved ends of the bumpers. As a result, it became necessary to arrange the anodes to conform to the shape of the bumpers. With these conforming anodes, the plating tank was divided into individual nests or cells and the work-pieces were lifted from and lowered into the cells, as well as

transferred between adjacent tanks, by manually controlled, overhead electric hoists. This set-up slowed production, and made it difficult to obtain uniform plating because the plater is responsible for the specified immersion periods in various cells.

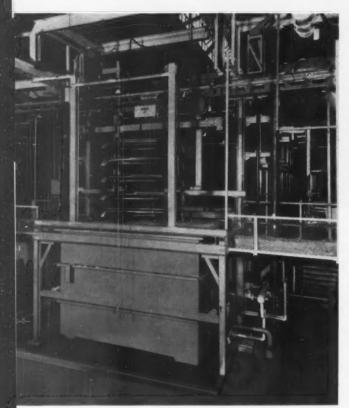
Now, by means of unique electrically controlled, hydraulically operated devices, Pontiac wrap-around bumpers are being plated uniformly and at high production rates on a straight-line, completely automatic machine built by the Udy-lite Corporation, Detroit, Mich. As shown in the heading illustration—a schematic lay-out of the installation—thirty-four tanks, 7 feet 4 inches deep and of various lengths, and five drain stations are arranged in line to provide an over-all machine length of 479 feet 11 inches. Operations performed in the various numbered tanks are identified in the accompanying table.

Production from the full automatic bumper plating machine is based on indexing the parts from tank to tank every two minutes with the



Operations Performed in the Bumper-Plating Tanks

Stations	Process	Tank Capacity, Gallons	Number of Cells	Solution	Submerge		
				Content	Ounces per Gallon	Temp. Deg. F.	or Plating Time. Minutes
1	Load and soak clean (heavy)	7000	2	Alkali	6	160	2 1/2
1A	Soak clean (finish)	5000	2	Alkali	6	160	2 1/2
2	Warm water power spray	Empty	1	Alkali	1.5	110	1.1/4
3	Power wash	Empty	3	Water		Room	3 3/4
4	Cathodic clean	10,000	3	Alkali	6 170		3 3/4
5	Rinse			Water			
U	Drain and transfer		1			Room	1 1/4
6		Space		0.11			3/4
	Acid dip	2800	1	Sulphuric acid	4	Room	1 1/4
7	Rinse		1	Water		Room	1.1/4
8	Cyanide dip	2800	1	Cyanide	1.5	Room	1.1/4
9	Copper-strike	13,000	4	Copper Free cyanide Sodium hydroxide Carbonates	4.5 1.25 1.25 8	150	5
10	Recovery rinse	2800	1	Water		Room	1.1/4
11	Rinse		1	Water		Room	11/4
12	Rinse		i	Water		Room	1.1/4
13	Acid dip	2800	i	Sulphuric acid	2.0	Room	1.1/4
10	Drain and transfer	Space		4		Kooni	1/2
14A	Acid copper	25,000	8	Dowheite	Cad	90	30
14B				Daybrite	Std.		
140	Acid copper	25,000	8	Daybrite	Std.	90	30
15	Drain and transfer	Space		197			1/2
15	Recovery rinse	2800	1	Water		Room	1.1/4
16	Rinse		1	Water		Room	1 1/4
17	Rinse		1	Water		Room	1.1/4
18	Nickel-strike	3200	1	Nickel Nickel chloride Single nickel salts Boric acid Hydrochloric acid (10 per cent by volume)	7 16 15 2	Room	1 1/4
	Drain and transfer	Space					1/2
19A	Nickel-plate	25,000	8	Udylite	Std.	130	30
19B	Nickel-plate	25,000	8	Udylite	Std.	130	30
	Drain and transfer	Space					1/2
20	Recovery rinse	2800	1	Water		Room	1 1/4
21	Rinse		1	Water	1	Room	1 1/4
22	Rinse		1	Water		Room	1 1 1/4
23	Acid dip	2800	1	Sulphuric acid	2	Room	11/4
24	Rinse		1	Water		Room	1.1/4
25	Rinse		1	Water		110	11/4
26	Chromium-plate	6000	2	Chromic acid sulphates	37	Room	2 1/2
		0000	-	(95 to 1 ratio to chromium content)	01	Koom	21/2
27	Recovery rinse	2800	1	Water		Room	1 1/4
28	Rinse		1	Water		Room	1 1/4
29	Rinse		1	Water		Room	1 1/4
30	Rinse		1			110	1 1/4
31	Hot-air blow-off						1 1/4
							1



lifting, transferring, and lowering of the workpieces requiring forty-five seconds. When the bumpers must be immersed in any particular tank longer than one and one-quarter minutes, that tank is divided into the required number of cells and one cell is loaded while another is unloaded every two minutes. Examples of such

Fig. 1. Loading end of straight-line automatic plating machine, showing rack loaded with bumpers above first tank.

tanks are 1 and 1A for soak cleaning (divided into two cells each), 3 and 4 for power washing and cathodic cleaning (three cells each), 9 for copper strike (four cells), 14A and 14B for acid copper (eight cells each), 19A and 19B for nickel-plating (eight cells each), and 26 for chromium-plating (two cells).

Cells are automatically selected in sequence by means of an ingenious arrangement of program timers, camshafts, limit switches, and hydraulically operated work-handling devices which will subsequently be described in detail. To prove the practicability of the unusual automation devices prior to starting the \$4,000,000 installation at Pontiac, Udylite built a working model 47 feet long, 9 feet wide, and 12 feet high.

Completely surrounding the plating machine, and designed as an integral part of the installation, is a Cleveland Tramrail overhead monorail loop approximately 1050 feet long. The monorail is equipped with twenty-one carriers, each propelled by an individual electric motor. A pair of hooks suspended below each monorail carrier is designed to support a rack-carrier beam, to which a plating rack is attached.

Front bumpers for the 1955 model Pontiac automobiles consist of a one-piece lower impact bar having an effective area of 6.30 square feet, and right- and left-hand upper front impact bars, each having an effective area of 2.41 square feet. Rear bumpers contain right- and left-hand rear

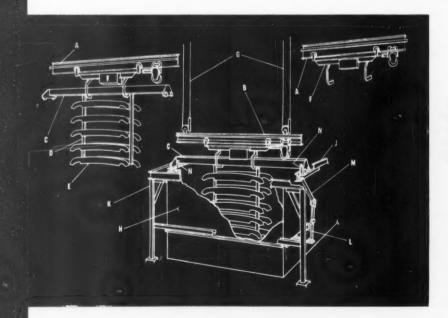


Fig. 2. Schematic drawing showing method of loading racks in tank. Movable section of monorail track (B) is lowered, and loaded rack-carrier beam (C) is pushed off hooks.

impact bars, each having an effective area of 2.14 square feet. The plating racks are designed to hold ten lower impact bars, or twenty right- or left-hand impact bars (either front or rear). When loaded with ten one-piece lower impact bars, each plating rack—together with the rack-carrier beam—weighs about 1500 pounds. Output from the plating machine is rated at 130 cars per hour, or 650 bumper parts—including 130 one-piece lower impact bars.

Bumper parts to be plated are manually placed on racks suspended from the monorail carriers at the loading station. As each loaded rack reaches a point over the first tank, Fig. 1, a movable section of the monorail track is automatically lowered by means of cables to submerge the loaded rack in the alkali soak cleaning tank. The four wheels on the under side of the rack-carrier beam come to rest on an angle-iron track, and the beam is hydraulically pushed along the track before the movable section of monorail track and the carrier are automatically raised.

This set-up is shown schematically in Fig. 2. The stationary sections of track forming part of the overhead monorail loop are indicated at A, and the movable section of monorail track at B. Rack-carrier beams C, to which plating rack D for holding bumpers E is attached, are suspended from a pair of hooks below each monorail carrier F. The carrier at the left is supporting a beam and rack loaded with bumpers, while that in the center has been lowered by means of cables G.

With the bumpers and rack submerged in the alkali soak cleaning tank H, the wheels on carrier beam C rest on angle-iron tracks J supported by the framework K of the plating machine. Hydraulic cylinders L (one on each side of the cleaning

tank) are connected by linkage M to pusher dogs N for moving the loaded beam along tracks J and off the carrier hooks. The movable section of track is then lifted, and the empty carrier continues around the monorail loop, as seen at the right

Some of the same parts are indicated by identical letters in a schematic side view of the workhandling mechanism, Fig. 3. This drawing also shows the automatic devices employed for lifting, transferring, and lowering the loaded beams from, between, and into successive plating tanks or cells. Since the bumpers must be soaked in the alkali baths for two and one-half minutes, both the heavy and finish-cleaning Tanks 1 and 1A are divided into two cells to permit the indexing cycle of one and one-quarter minutes. The first cell of Tank 1 is twice as long as the others to allow for immersion of the bumper parts and hydraulic transfer of the loaded rack-carrier beam.

After soaking for one and one-quarter minutes in the position shown in Fig. 3, the bumpers E together with the rack D on which they are mounted, rack-carrier beam C, and the section of track on which the beam wheels are resting -are raised out of the first cell. Then the beam is hydraulically pushed into a position above the second cell and lowered to submerge the bumpers into the alkali bath. This is accomplished by means of hydraulic lift cylinders O (one on each side of the cleaning tank), connected by linkages P to tension bars Q. Rack teeth on bars Q mesh with gears, such as the one seen at R, to multiply the stroke of the hydraulic cylinders. Gears on both sides of the machine are mounted on a common equalizer shaft.

Fig. 3. Side view of the workhandling device shows hydraulic cylinder (L) and linkage used to remove beam (C) from carrier (F). Cylinder (O) is employed to lift bumpers from tank.

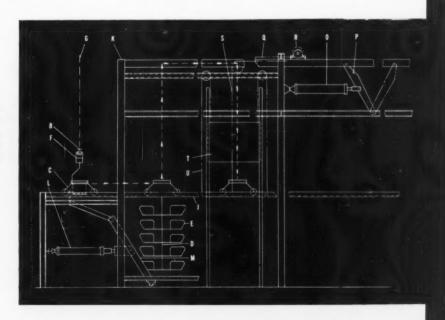


Fig. 4. Automatic cell selection is obtained by means of pivoting flipper gates (D) mounted on a lift gate or chassis (E) and actuated by roller cams (B) and program timer (C).

Lift chains S, of equal length, connect the tension bars to the track sections on which the rackcarrier beams rest. Counterweights T, suspended from chains U, are provided to assist in raising and lowering the loaded racks. The use of equalized tension bars eliminates the disadvantages of long chains which would otherwise be required. Long chains would have considerable elongation, thus interfering with successful operation.

The arrangement for automatic cell selection is shown schematically in Fig. 4. This set-up consists of gear-driven camshafts A (one on each side of the machine and geared together), which carry roller cams B set at various positions around the shafts to correspond with cams in the program timers C. Flipper gates D, which pivot on a lift gate or chassis E that is raised and lowered with each indexing, are pushed forward by the roller cams at regular intervals to form a continuous track for the rack-carrier beams. Guides for the flipper gates are indicated at F. and counterweight guides at G.

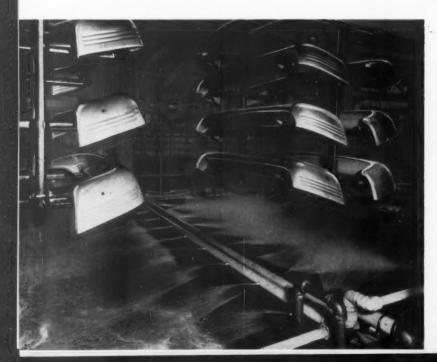


Fig. 5. In the power wash section of the plating machine, sprays of water from a manifold are directed on the bumpers as they are raised and lowered.

Mounted above each automatic cell selection unit are hydraulic motor-driven chains carrying two sets of pusher dogs spaced 180 degrees apart on the chains for advancing the loaded rack-carrier beams to the proper cell. Cells are automatically selected by means of limit switches electrically connected to the program timer.

A typical sequence of operations on an eightcell tank with the fifth cell empty is as follows: The program timer, controlled through limit switches, selects Cell 5, and cam rollers close the flipper gates for this cell. The chassis is hydraulically raised, and roller cams close all flipper gates in the up position—thus allowing the rackcarrier to be pushed by the chain dogs to a position over the fifth cell. Traverse is at high speed to a position over the preceding cell, and then at a decelerated rate to the final position. Then the chassis is lowered, submerging the bumpers in the required cell. The chain pusher dogs advance to a point just behind Cell 6, ready to engage the rack-carrier that will be lifted from this cell on the next indexing and transfer it to the next drain station or plating tank. The other set of chain pusher dogs will then advance the next rack-carrier from the preceding drain station to Cell 6.

Rate of rapid traverse of the rack-carriers is adjustable up to 200 feet per minute by means of hydraulic flow control valves. Also, lifting and lowering speeds can be adjusted between 25 and 40 feet per minute. A total of thirty-four hydraulic cylinders are used throughout the plating machine. Only three cylinder sizes are necessary. All lift cylinders are the same size and have a short stroke, which is multiplied by linkage, racks, and gears as required.

Hydraulic pressure for the cylinders is sup-

plied from five transfer pumps and six lift pumps. These eleven pumps are individually driven by electric motors having a total of 247 1/2 H.P. The pumps, cylinders, valves, and other hydraulic equipment, all supplied by Vickers Incorporated, are rated for a working pressure of 1000 pounds per square inch, but operate under a pressure of only 525 to 550 pounds per square inch.

All electrified tanks are equipped with elevated cathode contacts to permit the work to enter the tanks hot. The rack-carrier beams, formed from solid copper bars with insulated wheels, have four pads which slide between the elevated cathode contacts at both ends of each tank when the beam is lowered into or raised from the tank, Electrical current is supplied to eight tanks from twelve generators as follows: cathodic cleaning-Tank 4, one generator of 10,000 amperes, 9 volts; copper-strike-Tank 9, one generator of 10,000 amperes, 6 volts; acid copper-Tanks 14A and 14B, four generators each of 15,000 amperes, 6 volts: nickel-strike-one generator of 2500 amperes, 6 volts; nickel-plating-two generators of 15,000 amperes, 6 volts, and one generator of 10,000 amperes, 6 volts; and chromium-platingtwo generators each of 10,000 amperes, 12 volts.

A nickel strike is employed to insure good adhesion between the copper-plating and nickel-plating. Also, since the bumpers are in the air for one and one-half minutes between the copperand nickel-plating operations, the nickel strike prevents tarnishing. Total plating thickness is approximately 0.0015 inch—made up of about 0.0007 inch of copper and 0.0008 inch of nickel. Chromium plate is only 0.00001 to 0.00002 inch thick.

In Fig. 5 are illustrated racks of bumpers over the power spray wash section of the plating ma-

Fig. 6. View illustrating the end of the acid copper-plating operation (Tank 14B). The bumpers are submerged in the air-agitated solution.



chine. The end of the acid copper-plating Tank 14B is shown in Fig. 6, with the drain and transfer station between Tanks 14B and 15 visible at the lower right. In this view, the work-carrier is in the down, or plating, position, with the bumpers submerged in the copper-plating solution. The conforming anodes which form the nest into which the racks of bumpers are lowered, can be seen in the last cell of Tank 14B; and the current-carrying, copper precontact slides, between which the pads on the rack-carrier beam move, are shown extending above the far ends of the tank cells.

The two Koroseal-lined acid copper-plating tanks are each 50 feet long, contain eight cells, and hold 25,000 gallons of solution. Air is employed for agitation, and the solution requires constant cooling to maintain the 90-degree F. temperature necessary for successful plating. The solution is cooled by constant circulation through water-cooled heat exchangers. Water is conserved by discharging it from the heat exchanger into rinse tanks.

Water from the recovery rinse Tank 15 (into which the bumpers are immersed immediately after acid copper-plating) is distilled once every twenty-four hours. Copper is removed from

the solution, and approximately 500 pounds of copper are recovered per week. This copper is sold as scrap. After removing most of the copper from the solution, the remaining acid is neutralized before being discharged into drains.

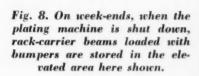
After being nickel-plated in either Tank 19A or 19B, the parts enter recovery rinse Tank 20. Here, nickel is reclaimed through distillation, and the solution is pumped back into the plating tanks. Reclaimed nickel is returned and recast into anodes. The nickel-plating solution itself is continuously circulated through electro-purification tanks supplied with power from rectifiers for plating out metallic impurities.

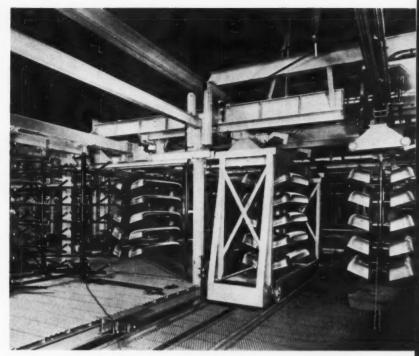
Chromium-plating Tank 26, contains two Koroseal-lined cells having brick bottoms. These cells have conforming anodes in their centers to insure adequate plating of recessed areas and ends of the bumpers. Chromium is salvaged by recovery rinse Tank 27, with the solution being distilled once every twenty-four hours to obtain about 500 pounds of chromium per week.

Loaded racks are transferred in their down position through the two-station Tank 31, while the bumpers are dried by hot air blow-off. As the racks are raised from this tank, the beams are picked up by the hooks on the monorail carriers.



Fig. 7. Plated bumpers are inspected manually, removed from the racks, and sent to final assembly. The racks then pass through a strip tank prior to being reloaded.





The parts are then transferred to the unloading station, Fig. 7, by means of the automatic rack-handling system. Here, plated bumpers are inspected, manually removed from the racks, and sent to the final assembly line.

Empty racks and the beams on which they are mounted are transferred by the monorail carriers through a rack strip system. First, the carriers lower the racks into an eight-station alkali strip tank containing a solution made up of 5 ounces of soda ash per gallon of water. The carriers are electrified to provide a current density of 20 amperes per square foot during stripping. At the end of the strip tank, the racks are elevated. They pass through a power spray washer before they go to the loading station to be reloaded with unplated bumpers. Efficient stripping of the racks is essential to satisfactory results because carryback of chromium into the copper-plating solution cannot be tolerated.

Service of this huge plating installation is relatively simple. The machine is presently being operated continuously twenty-four hours a day, five days a week. At the end of each week, all eighty-six racks (loaded with bumpers so that they are ready to enter the machine at the start of the next week) are conveyed by means of the monorail carriers to an elevated rack storage area located at the left-hand end of the installation. As shown in Fig. 8, a shuttle car is provided to transfer the loaded racks of bumper parts from the monorail carriers to the proper row in the storage area.

Solutions in the various tanks are laboratorytested twice a day, with make-up constituents being added as required. Anodes are serviced or replaced every two weeks, during a week-end shut-down. For anode servicing, the solutions are pumped to storage tanks.

Alkali solution in heavy-cleaning Tank 1 is discarded every two weeks. At the same time, the alkali solution in finish-cleaning Tank 1A is pumped into Tank 1, and new solution is provided for Tank 1A.

A catwalk with sliding doors to permit access to the various tanks extends the full length along both sides of the machine. Also, a cable is provided along both sides of the machine which can be pulled or kicked by any supervisory personnel to immediately stop operation of the machine. An intercommunicating telephone system is also available with instruments at various points along the machine. Before the machine is placed in operation at any time, a loud signal is sounded.

The installation of all tanks above the floor (giving an over-all machine height of 18 feet 3 inches) simplifies maintenance, as it is easy to reach the drains, piping, valves, and associated equipment. A major advantage resulting from the in-line design of the machine is that a minimum number of plating racks are required. Plating racks are usually the most expensive single item in an installation of this type. For this reason, only as many racks should be on hand as are required for production schedules. Every rack is in actual use at Pontiac.

Selective



Versatility of hopper feeds makes it practical to convert production of a machine to another size or even another part in a reasonable length of time. Methods of selectively feeding various work-pieces, and applications of both rotary barrel and vibratory bowl type hoppers to different types of machines are described and illustrated in this article

By ROBERT F. GLADFELTER

Detroit Power Screwdriver Co.

Detroit, Mich.

Feeding Devices Increase Automation Versatility

A PPLICATION of automation principles need not be restricted to large mass-production plants, such as those in the automotive industry. Although it is true that complex, single-purpose automation devices and huge transfer machines can only be justified economically when large numbers of identical parts are to be manufactured, many automatic loading, unloading, and conveying devices are applicable to numerous small and medium-size plants where peak efficiency is every bit as important.

Hopper feeds which automatically select and deliver parts to machines for further processing are one example of the degree of flexibility possible in automation. Such feeding devices make it practical to convert the production of a machine to another size, or even another part, in a reasonable length of time.

Motorized hopper units, although among the oldest and most popular feeding and sorting devices commercially available, are being increasingly applied in numerous plants producing widely diversified products. Such units reduce costs by making operations more automatic, increasing production, conserving manpower, and insuring consistently uniform quality. Productivity increases ranging up to 400 per cent have been obtained by adapting hoppers to existing equipment and machines. Hopper units have been applied to presses, centerless grinders, thread rolling machines, and many special machines for feeding screws, blanks, rivets, pins, discs, nuts, washers, rollers, balls, and other parts of this general category.

Types of Hopper Feeding Devices

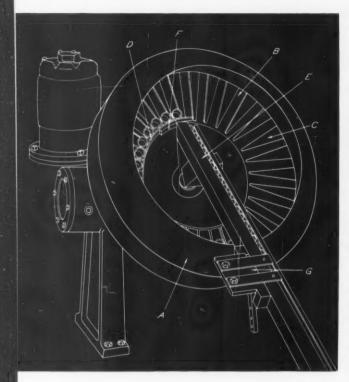
Two basic types of hopper feeding units are the rotary barrel type and the vibratory bowl type. The advantage of the barrel design is that it selects, orients, and feeds parts in a uniform position for primary and secondary machining operations, as well as for assembly purposes. Although each unit is designed and built to perform a specific job, it can be converted readily to feed parts other than those for which it was originally designed.

A typical barrel-feeder is illustrated in Fig. 1. Parts to be sorted and fed are dumped inside cover A. A series of radial slots or grooves B are milled in rotating collector ring C, the slots varying in width and shape to suit the work-pieces to be handled. For example, in feeding headed objects, such as screws or bolts, the slots are cut through the collector ring; for nuts or rectangular parts, the slots have sharp corners; and for cylindrical work-pieces, such as pins or dowels, the slots have rounded corners.

On barrel-feeders made by the Detroit Power Screwdriver Co., collector ring C is rotated by a fractional-horsepower motor through a gear train, consisting of a worm, worm-gear, pinion, and bevel gear. In this way, speed is reduced from 1725 R.P.M. at the motor to 9 R.P.M at the collector ring. Also, the units are provided with a friction drive which will slip in case of obstruction in the hopper, thus preventing any damage to the motor or gears.

Work-pieces, picked up by the slots in the collector ring as it passes through the supply stored inside the cover, are retained by a stationary baffle plate D until they reach the entry end of track E. Here, a selector guard F, attached to the baffle plate, allows parts that are correctly positioned in the slots to pass into the track, from which they are fed to a machine by gravity.

Work-pieces that are not correctly oriented are rejected and fall back inside the hopper cover. Adjustable feed limiting devices or escapements, such as the one shown at G (Fig. 1), are employed to regulate discharge of parts from the track one or more at a time. Such escapements can be cam type mechanical units, solenoid-actuated, or air-operated, depending on the job. The escapement mechanism illustrated is actuated by a lever which can be connected by



rod to a press and controlled by movement of the press ram. Feed rates will vary with the workpieces. For example, steel balls 1/32 inch in diameter have been fed at rates as high as 1800 per minute. Bolts as long as 4 inches have been selectively fed with such devices.

Various Units for Feeding Parts in Required Position

Various types of selector guards and other units have been developed for allowing the parts to pass from the hopper into the track only when

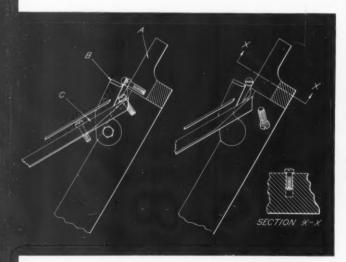


Fig. 1. Typical rotary barrel type feeding unit has a cover (A), radial slots (B), rotating collector ring (C), stationary baffle plate (D), and track (E).

they are in the required position for subsequent machining or assembling. To illustrate, the setup in Fig. 2 is employed to feed into the track, fillister-head machine screws hanging by their heads. As seen at the left, correctly positioned screws pass from collector ring A, under selector guard B, and into track C. However, incorrectly positioned parts, as shown at the right, are prevented from entering the track by the guard, and fall back inside the hopper cover. The guard can be pivoted to accommodate screws having heads of various diameters.

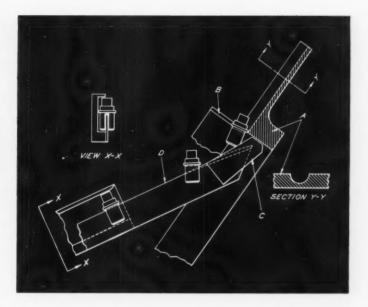
In Fig. 3 is shown a hopper set-up used for feeding slotted parts with their slots facing downward. The work-pieces slide down the grooves in collector ring A and under guard B and are guided by side-plates C onto the knife-edge end of rail type track D. As the parts drop onto the track, the slotted ends of some parts will fall over the track. These parts will slide down the track, as seen in view X-X, and other parts will fall back into the hopper.

Sometimes a gap is provided in the hopper feeding track for the selection of parts by means of a formed opening, and to prevent the possibility of jamming the parts. Such a device is illustrated in Fig. 4. Here, flanged stampings slide from slots in collector ring A, under guard B, and into an open top, upper track section C. An adjustable air gap is provided between this upper section and lower track section D. The entry end to the lower section has a formed opening, view X-X, so that only stampings having their flanged sides down can enter this section. Stampings leaving the upper track section with flanged side up are deflected back into the hopper, as seen at the upper left.

Cylindrical work-pieces with chamfered or rounded edges on one side and sharp edges on the other, which must be fed to a machine with their sharp-edged sides down, can be handled by means of the hopper set-up shown in Fig. 5. In this installation, the track is tilted and a guide rail A projecting only slightly above the bottom of the track is provided. Thus, incorrectly positioned work-pieces (with round or chamfered edges facing down) slide over the low rail and fall out of the angular section of track into the

Fig. 2. Set-up for feeding fillister-head machine screws hanging by their heads. Incorrectly positioned parts are prevented from entering track (C) by guard (B).

Fig. 3. Slotted work-pieces slide down grooves in the rotating collector ring (A), under guard (B) and onto a rail type track (D) leading to the machine.



hopper. Parts having their sharp-edged sides down, as required, are retained by the rail and continue down the track.

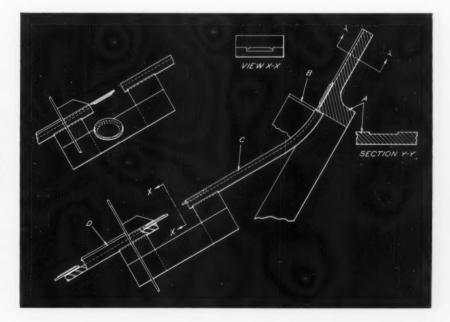
In Fig. 6 is illustrated another method of selecting and feeding flanged stampings having their flanged sides facing downward. Stampings properly oriented slide uninterrupted down track A. However, incorrectly positioned pieces are lifted out of the track by bowed covers B and ejected back into the hopper by deflector C.

Feeding of Multiple-Diameter Shafts

Spring-loaded pressure pins are often employed for the selective feeding of multiple-

diameter shafts or studs from hoppers. For example, in the set-up seen in Fig. 7, four spring-loaded pressure pins A are used to insure that shafts enter track B with their threaded, large-diameter ends leading. If the shafts are correctly positioned in the grooves of collector ring C as it rotates clockwise, they will slide from the ring into the track, as seen at the right. However, if the shafts are improperly oriented in the ring grooves, they are restrained from sliding into the track by the pressure pins A, as shown at the left. When such shafts are carried past the last of the four pins, they fall back into the hopper. The pin-holder can be adjusted to suit the various sizes of work-pieces.

Fig. 4. Air gap between upper track section (C) and lower section (D) prevents jamming. Parts are selected by a formed opening, view X-X.



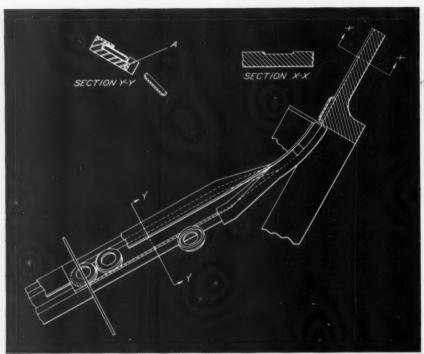
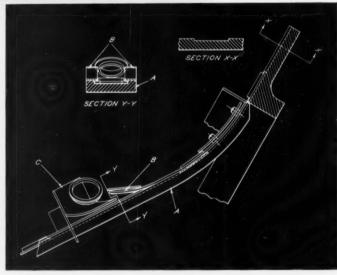


Fig. 5. (Above) Parts having a chamfer or rounded edge on one side can be automatically rejected by tilting the track and providing a low guide rail (A).

Fig. 6. (Right) Flanged stampings which enter track (A) improperly oriented are directed back into hopper by covers (B) and deflector (C).



Occasionally, it is easier in selecting workpieces to place them in the track in a position opposite to that required in the machine. Then, when they must be turned upside down, a simple half twist in the track can be employed. Or, a quarter twist in the track can be used where the parts must be picked up in a vertical position in the hopper and fed to the machine in a horizontal position.

A typical application of a selective feeding device is shown in Fig. 8. Here, nuts are fed, one at a time, from a rotary barrel type hopper into the locating nests of a fourteen-station indexing fixture mounted on the table of a tapping machine. From the unloading end of the hopper track, each nut is pressed into one of the locating nests by means of an overhead air-actuated plunger mounted on the machine table. When the nuts have been tapped, they fall through the fixture to a discharge chute seen below the hopper. This set-up more than doubled production.

Barrel Type Hopper Applications for Assembly

The application of two rotary barrel type hoppers to an interesting assembly operation is seen in Fig. 9. The operation consists of pressing

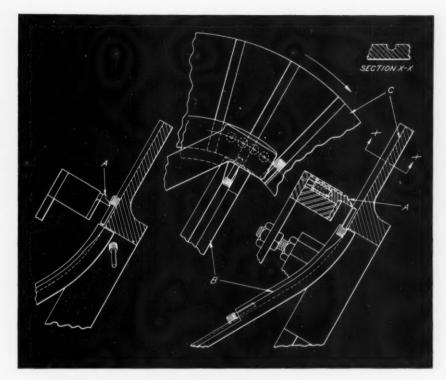


Fig. 7. Spring-loaded pressure pins (A) are here employed to insure that shafts enter track (B) with their threaded large-diameter ends leading.

brazing rings into both ends of solid cylindrical pistons, which have been previously under-cut to receive the rings. Pistons that have been dumped indiscriminately into the hopper at the right are fed by gravity down the track and pushed into an assembly nest.

The left-hand hopper is equipped with two tracks for delivering brazing rings to both sides of the assembly nest. Here, toggle type presses operated by air cylinders push a ring into each end of the piston. When the next piston is advanced into the nest, the assembly is forced out onto the discharge chute seen at the front of the machine. A production of sixty assemblies per minute is obtained in this completely automatic operation.

An automatic set-up for the loose assembly of split lock washers to automotive body bolts is shown in Fig. 10. The assemblies, consisting of one washer on a bolt, are pre-loaded into magazines, such as the one seen at the lower left. These magazines hold eighteen assemblies each and are subsequently employed on the automobile assembly line.

Fig. 8. Rotary barrel type hopper at right feeds nuts to fourteen-station indexing fixture on the table of this single-spindle tapping machine. Production has been doubled with this set-up.



MACHINERY, March, 1955-193

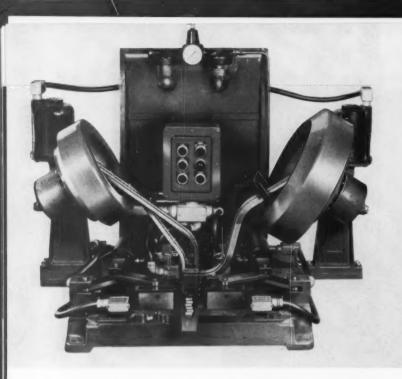


Fig. 9. Dual tracks on the lefthand hopper feed brazing rings which are pressed into both ends of pistons fed from the righthand hopper and held in a nest.

The bolts, 3/8 inch in diameter by 2 1/2 inches long, are fed from the rotary barrel type hopper at the right (Fig. 10). At the end of the hopper track, air-actuated fingers pick up each bolt and press it through the washer bore—the washers being fed from the hopper at the left. When the fingers release the bolt, the assembly is pushed into the magazine by means of an air cylinder seen below the right-hand hopper. Each magazine is loaded with assemblies in three seconds,

and it is only necessary for the operator to unload full magazines and replace them with empty ones.

Three rotary barrel type hoppers are employed on the assembly machine seen in Fig. 11. This machine automatically puts together the "bale-nuts" for carburetor bowl adjustment units at the rate of thirty-eight per minute. Nuts are fed from one hopper, bowls from another, and studs from the third—the assembly being built

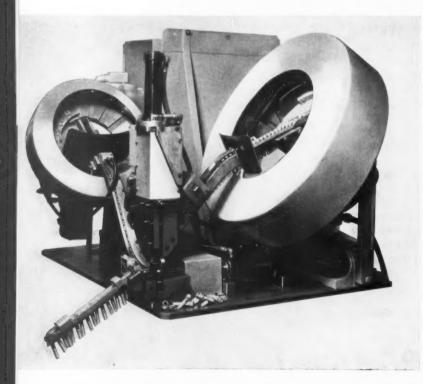


Fig. 10. Assembly machine for placing split lock washers on automotive body bolts and preloading assemblies into magazines holding eighteen units.

Fig. 11. Three rotary barrel type hoppers are used in this set-up for feeding nuts, bowls, and studs employed in "bale-nut" assemblies for carburetor adjustment units.

up as it progresses around the rotary indexing table of the machine.

Vibratory bowl type units are unique selective feeding devices that select and handle parts not adaptable to other types of feeding devices. They are particularly suitable for parts that will not withstand churning or tumbling, and for parts too light or fragile for other type feeders.

In this type feeding unit, the bowl into which the work-pieces are dumped does not rotate, and is freely mounted on Z-springs. A solenoid type vibrating coil is employed to strike a blow against the bowl in a direction opposite to that in which the parts are to be fed. A rectifier supplies direct current to the coil, and a rheostat is supplied to control the current input, thus increasing on decreasing the vibration cycles.

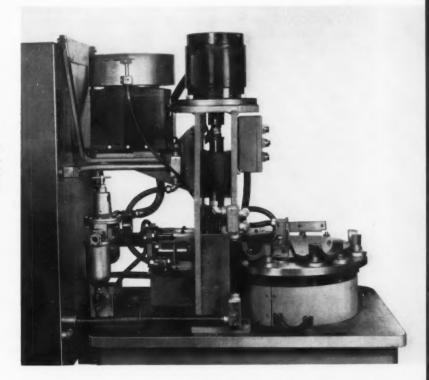
Work-pieces are caused to move clockwise or counter-clockwise, and move up a circular inclined ramp on the inner face of the bowl. From this ramp, the parts enter one or more feed-tubes or discharge tracks leading to the work area of the machine.

One application of a bowl feeder is illustrated in Fig. 12. Here, two locating pins are pressed



into previously drilled holes in cast-iron main bearing caps. The pins are hopper-fed from a vibratory bowl type unit, seen at the upper left, having dual discharge tubes. The operator merely loads bearing-cap castings in the fixtures of a six-station rotary indexing table. When the castings have been indexed below the tubes, a locating pin falls into each hole. Then, the pins are pressed into the castings by means of air-operated press tools, and the assemblies are automatically ejected from the table.

Fig. 12. Locating pins which are pressed into holes drilled in castiron main bearing caps are fed from vibratory bowl type unit at upper left.



Transfer Press Triples Valve-Cover Production

POR many years all Buick engines have been equipped with deep-drawn stampings as covers for their overhead valves. These stampings are designed with bead-like stiffening ribs and a continuous peripheral flange. The purpose of the flange, when used with a gasket, is to provide a tight joint at a mating flat surface on the engine head. Two such stampings are required on each V-8 engine.

Until recently, these covers, produced by the Buick Motors Division of General Motors Corporation, Flint, Mich., were drawn in one die and then transferred to dies in other presses for trimming and for other supplementary operations. A total of six men were required to run the job. To accelerate production, which was at a rate of 275 covers per hour, a single 600-ton Verson "Transmat" press was installed. By using a six-station progressive die, two men turned out 800 completed covers per hour.

Coil stock, 0.042 inch thick and 24 1/8 inches wide, is fed from a Littel reel shown at the right in Fig. 1. This strip width is 5/8 inch narrower than was previously necessary. From the reel, the stock passes through a set of leveling rolls and a feeding device shown at the left in the illustration. The feeding unit is actuated by transfer bars that are a part of the press. While passing through the leveling and feeding rolls, the strip is automatically sprayed with a coating of Mac No. 291 drawing compound that has been diluted with an equal part of water.

The press bed and the progressive die may be seen in Fig. 2. Advance of the coil stock into the die, and the work-pieces through the die, is accomplished by a pair of transfer bars that are reciprocated by the press. Each transfer bar carries a set of gripping fingers that engage the work-pieces at each end and advance them to the next station. After depositing each piece in the correct position for the next stroke, the fingers are disengaged. During the press stroke, the disengaged transfer bars move outward and back one station, where they are ready to repeat the transfer cycle for the next working stroke.

Triangular openings are notched in the flat stock at the first die station. Punched scrap drops through the die and into chutes leading to waste boxes. Two operations take place in a single stroke of the press after indexing to the second station. The blank is severed from the strip, and drawn into a trough-like shape with closed and rounded ends. At the same time, the die produces two transverse stiffening ribs.

No work is performed at the third station. To maintain the proper indexing sequence, however, the work-piece is disengaged at this station and remains there ready to be picked up on the next transfer movement. After being indexed to the fourth station, the piece is re-struck for precise sizing and a shallow groove is formed around the flange for stiffening purposes. Also, two stud holes are pierced in the top surface.

One side of the flange is trimmed at the fifth station. Removed stock is pushed through the die and falls into a waste box. At the sixth station, the opposite side and both ends of the flange are trimmed to complete the stamping. The next indexing movement ejects the cover from the die, from which point it feeds along a track shown at the right in Fig. 3.

These operations complete the forming of the cover, but the drawing compound and oil must still be removed. Therefore, the stampings are fed from the track onto a short incline leading into an automatic washing machine. The stampings are advanced through spray-cleaning zones by a conveyor. When the parts emerge, they are ready for transfer to the assembly department.

Coil stock advancing to the press from a reel must enter the leveling rolls during each feed movement, hence, when the stock on the reel runs out, the starting end of a new coil must be joined to it. This is done by hand gas-welding the two ends together in the form of a butt joint so that there is no significant change in stock thickness that would require readjustment of the rolls. Welding is done, of course, when the press has stopped. Only a short delay is encountered.



Hulli



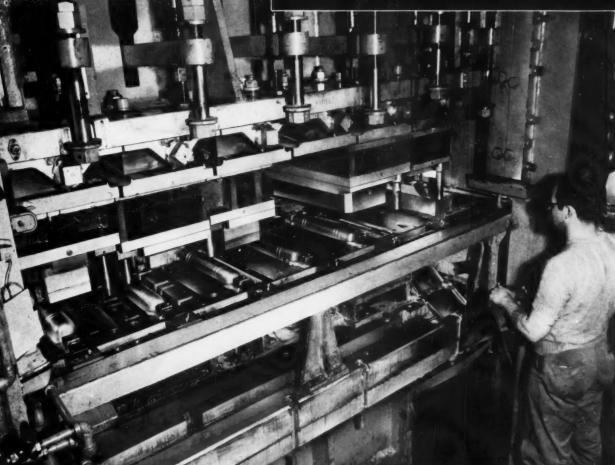
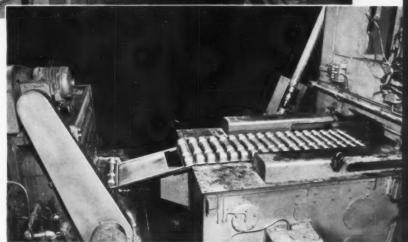


Fig. 1. (Top) Coil stock being drawn through leveling and feeding rolls, left, is automatically sprayed with drawing compound

Fig. 2. (Center) Six-station progressive die notches, shears, draws, pierces, and trims valve covers at rate of 800 an hour

Fig. 3. (Right) Completed valve covers pass into an automatic washing machine

MACHINERY, March, 1955-197







Por nearly a decade, the continuous automatic production of manufactured goods by automation processes has been applied in various industries. However, automation is relatively new to metal-working, and so is constantly being appraised by many manufacturing plants in that industry. In evaluating automation processes, such questions as How are we doing?, What are the problems?, What is the real picture on costs?, and Where do we go from here? are raised. All these questions are timely; a few of them are not finding ready answers.

To obtain maximum efficiency and economy from automation, a careful analysis must be

made of the cutting tools to be employed. For example, the Sundstrand Machine Tool Co., Rockford, Ill., never proceeds beyond the initial planning stages for automation equipment without giving prime consideration to cutting tools and product design requirements. Roy Monosmith, master mechanic at Sundstrand, has this to say: "In every machine tool we design for automation, or even general metal-working, serious consideration is given to cutting tool design and application. It would be difficult for me to see how any machine tool can be intelligently built or process-planned without primary consideration for the cutting tool. The day is long past

Tooling for Automation

By W. BADER, Vice-President

Research and Development Department
Wesson Co., Ferndale, Mich.

when the machine tool is designed and built—and then tooled. The interdependence of both machine and cutting tool design dictates that both be developed together. So complex are today's machines and processes that a team of engineers, including tool engineers, can be the only approach to automation planning and implementation."

The impelling reason for automation is the manufacture of more products more economically. The key word is economy. An appraisal of automation therefore must necessarily hinge upon the accomplishment of this objective. Without a doubt, automation is turning out more products and in greater abundance, but how have costs really been affected? It is a well-known fact that with the installation of automatic equipment, direct manufacturing costs have declined. However, in the words of one automotive production executive, "... The justification for automation is cost reduction, but it seems that after reducing standard hours by two-thirds, the 100 per cent overhead rises to 300 per cent."

Maintenance is the critical problem. Although this is true in varying degrees for the entire process, a major portion of higher maintenance costs is reflected in excessive down time through tool failure, limited tool life, and other tool factors. Due to this, manufacturing concerns, as well as machine tool builders, are looking at tooling as an important avenue for indirect cost reductions. Also, they are showing increasing interest in the developments coming out of carbide and cutting tool research and development laboratories.

The evolution of cutting tools during the last twenty years has been greatly advanced by the continual development of cemented carbides. Although several radically new tool types have been developed, the single-point tool designs (whether brazed or mechanically held) have remained basically unchanged. Virtually the same shapes are being produced as were made twenty years ago.

Mechanically held carbide tool-holders with

Fig. 1. Adjustable clamp has carbide tip which serves as a chip-breaker, thus eliminating the need for grinding a chipbreaker on the tool.

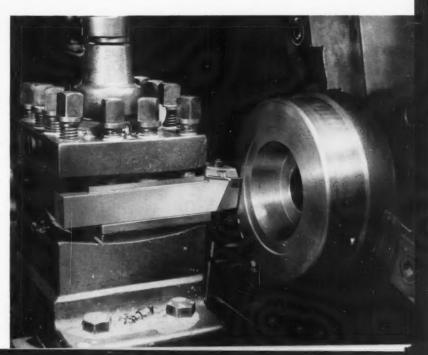


Fig. 2. By mounting locking wedges beneath blades, as many as five or six blades per inch of diameter can be provided on milling cutter.



their throw-away inserts provide features that reduce or hold down indirect costs of maintenance, but they are not a cure-all. When the first types of mechanically held tool-holders were introduced to metal-working, it was thought by some manufacturers that brazed type tools had outlived their usefulness. That such claims proved wrong is borne out by the continuing demand for these tools.

Advantages of brazed type single-point tools include a wide range of shank sizes, high positive-rake and cutting-clearance angles, and low cost. However, using mechanically held tool-holders shortens tool change periods and extends production significantly. As the word "throw-away" implies, all carbide grinding is eliminated where these holders and inserts are used. Specifically,

these holders are designed for semi-finishing and finishing cuts. On inserts which provide up to eight or more cutting edges, important savings are possible.

Adjustable combination carbide-tipped chipbreakers and clamps, Fig. 1, have been designed for use with mechanically held tool-holders. Significant cost reductions can be effected through their use as they eliminate the necessity of the time-consuming operation of grinding chipbreakers.

In the field of broaching, the throw-away principle has been applied to several tool designs. The Wesson broaching tool has a clamp that rides on a differential screw. This screw may be loosened with only slight turning. Then the tip can be removed and indexed with one hand

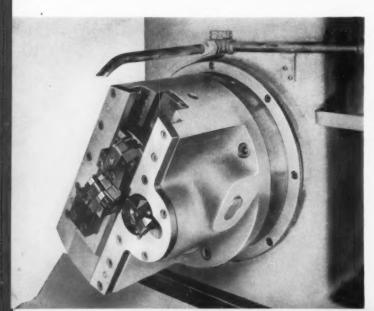


Fig. 3. Generating boring head equipped with band type holders and solid-carbide inserts for rough-facing the web and flange on the cylinder end of the compressor crankcase

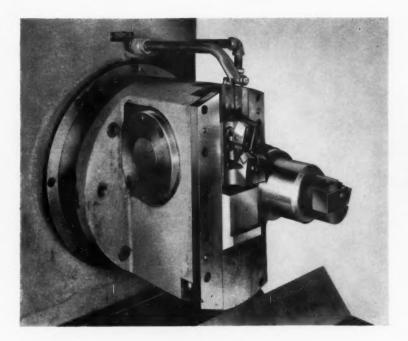


Fig. 4. Stator end of air-conditioning compressor crankcase is bored, chamfered, and faced with this multiple-tool head, maintaining concentricity to 0.001 inch.

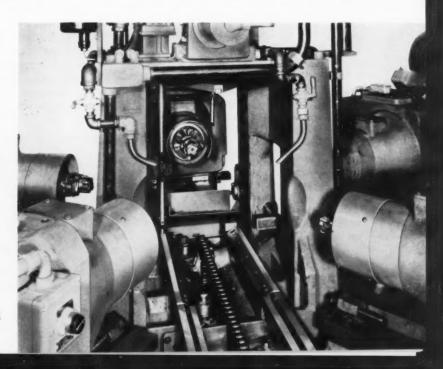
while the insert seat is cleaned by an air blast with the other hand. Seemingly, this is a minor feature, but real savings can result, especially when broaches, such as the one seen in the heading illustration, containing numerous such tools, require indexing.

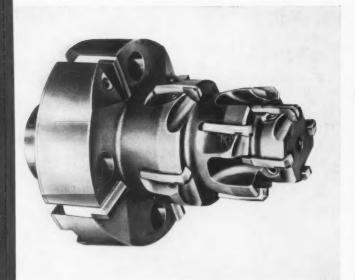
In the field of milling, many advancements have been made in cutter design. Typical of such advances are the Wesson Rigidcut cutters seen in Fig. 2. Hardened-steel locking wedges are provided beneath the blades in this cutter series. Because of this feature, as many as five or six blades can be employed per inch of cutter diameter. The result is that milling feeds of 100

inches per minute can be used. Such feeds were considered impractical only a few years ago.

In the field of special tooling, advances have also been made that have resulted in drastically reduced down time, maintenance, and production costs, especially as applied to automation. One example is the tooling used in producing air-conditioning compressor crankcases on a completely automated line. With this tooling, approximately \$12,600 has been saved over previous methods of manufacturing in producing 3600 crankcases. This saving resulted from reduced production time alone. Exact savings in reduced tool maintenance have not been computed. How-

Fig. 5. Compressor crankcases are automatically fed into position on this five-way cylinder boring machine. One of the multiple-diameter boring heads can be seen in the next illustration.





ever, the new tooling produces approximately 2800 crankcases per grind in contrast to 250 per grind with previous methods.

Machining of the compressor crankcases consists of one boring and two facing operations on the case web, dowel, and cylinder faces of the cylinder end, and practically identical operations performed simultaneously on the stator end. The tooling for these operations consists of specially designed band type Multicut holders with Wessonmetal carbide inserts. The holders are bolted to generating boring heads, as seen in Figs. 3 and 4. The tooling for the cylinder end of the crankcase is illustrated in Fig. 3, and the tooling for the stator end, in Fig. 4.

On this same crankcase production line, Fig. 5, multiple-diameter boring heads are also producing similarly large savings, especially in maintenance. One head, Fig. 6, performs a total of ten operations. The heads are set up on a five-way boring machine; and face, bore, and chamfer the cylinders in one cycle. Previously, one cylinder was bored at a time.

Another example of progressive tool engineering and the ability to meet present production

Fig. 6. Six surfaces in each crankcase are bored, three are chamfered, and its cylinder flange is faced by means of this special multiple-diameter head.

requirements economically is the boring cutter illustrated in Fig. 7. This boring cutter was specifically designed to bore the bushing hole in tractor track links, and is employed on a transfer machine which rough- and finish-bores both pin and bushing holes at three stations.

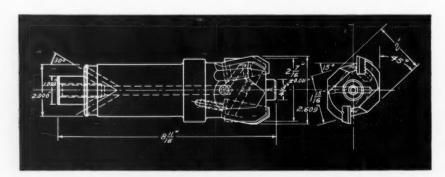
The track-link material (an extremely tough steel alloy) coupled with the boring operation being performed in a blind hole, created several unusual problems at the speeds and feeds necessary for the required production. It was recognized that the chips produced had to be small to keep the cutter from jamming in the workpiece. Also, it was known that conventional chipbreakers would not provide economical life since the material to be machined is so abrasive.

The solutions to these problems were evolved only through considerable trial and error. Oddly enough, this successful design embodies several features which ordinarily might be considered bad practice. An adjustable, solid-carbide chipbreaker was provided to solve the chip-breaker problem. This breaker serves a dual purpose, since it also acts as a blade lock by pressing against the carbide tip on the blade. These features, in addition to the unorthodox position of the conventional blade lock at the end of the blade shank, are considered poor practice.

The chip removal problem was solved by developing specially designed rake angles and by washing away the chips with coolant. The coolant passes through the cutter body and flows out of holes drilled in the head of the cutter, immediately adjacent to the adjustable carbide chipbreakers.

In the final analysis, it can be seen that cutting tool and carbide manufacturers are keeping up with every phase of technological development. Constant research and development will continue to produce the tooling and carbides to meet current and future demands.

Fig. 7. Coolant is supplied through the shank of this special cutter used to bore bushing end of tractor track links. Cutter has two solid-carbide blades.



Previous Articles on Automation

Following is a list of articles published in MACHINERY during the last ten years which presented detailed information concerning various phases of automation equipment as applied to machining, grinding, inspecting, assembling, forming, painting, plating, and several other similar operations.

These articles can be consulted in the bound volumes of MACHINERY in the main libraries of cities across the nation, in the plant libraries of some of the larger industrial corporations, and in the libraries of engineering societies. Photostatic copies of the articles can be obtained through Machinery at nominal cost.

Buick's Production

1950

Automatic Machines

p. 154, Automatic or Hand-Operated?

Machines

p. 154, Transfer Type Machines Produce Reo's "Gold Comet" Truck Engine

p. 162, Cost-Cutting Machine Tools Boost

p. 170, Packard's Ultramatic Drive Built by

p. 160, Machining Automotive Transmission

p. 138, Hopper Selector Mechanisms for

p. 146. There's Profit in Automatic Gaging

Cases on Transfer-matics

Precision Manufacturing Methods p. 156, Design of Hoppers for Automatic

- p. 158, Unusual Results with Automatic Soldering
 - p. 162, Machine Grouping Eliminated Center-Wing Bottlenecks

1946

- p. 148, The Automatic Manufacturing Plant -Mass Production Shop of the Future
- Apr. p. 152, Manufacture of Welding Electrodes
- p. 139, Ford Cylinder Sleeve Production Embodies Unique Engineering Ideas
- Polishing and Plating Oldsmobile p. 158, Three-Piece Bumpers
- Ingenious Work-Transfer Mechanp. 139, isms for Progressive Dies

1947

- p. 165, Automatic Forming and Assembling of Condenser Fins
- p. 141, Ingenious Equipment Used in Making Split Bushings
- p. 171, Precision Boring of Cylinder Blocks on an Automatic Transfer Machine
- p. 192, Transfer Machine of Sectional Design

- p. 139, Producing the New Studebaker
- p. 161, High-Speed Machining of Rear-Axle Housings on a Transfer-matic
- June p. 162, Efficient Handling of Work and Scrap in Automatic Press Operations
- p. 153, Deep-Drilling of Crankshafts on Transfer Type Machines
- Ford's New Methods of Forming and Nov. p. 152, Machining Axle Housings
 - p. 208, Electroplating Methods Used in One of the World's Largest Installations

June p. 162, Deep-Drawing of Stainless Steel on Transfer Type Presses

Sept. p. 144, Automatic Facing and Threading

Feb.

- Machines Speed Pipe Production p. 158, "Brain Block" Control of Standard
 - Lathe Increases Output Seven Times
- Nov. p. 177, Forming Washing Machine Legs on a Transfer Type Press

1951

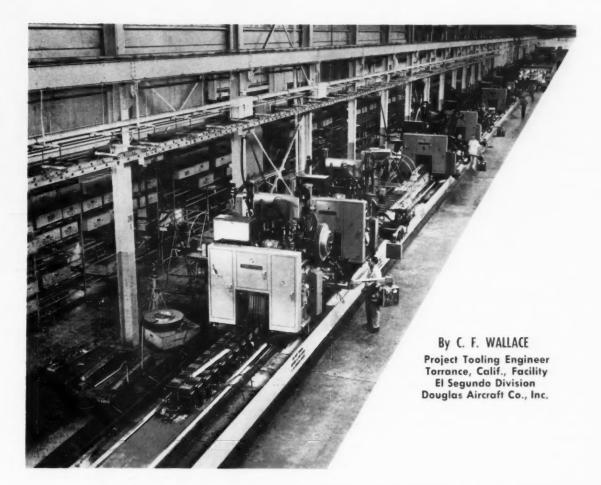
- Mar. p. 152, Buick Uses Carbide to Broach at 120 Feet per Minute
 - p. 158, Designing Hopper Feeds for Square and Hexagonal Nuts
 - p. 163, Revacycle Process Increases Chrysler's Gear Production
- Apr. p. 173, Longitudinal Operations Performed on Automatic Transfer Machine
- p. 182, Recent Advances in Gaging Practice June p. 149, Precision Machining of Studebaker
- **Automatic Transmission Parts** p. 137, Safety-The Keynote in New Olds-Aug. mobile Press Set-Up

- 1949 p. 147, Automation-An Outstanding Method of Increasing Production
- p. 149, Transfer Type Presses Speed Output of Electric Ranges
- p. 146, Modern Tooling Methods Employed in Building Cadillac's High-Compression Engine

1952

- p. 141, The Machines that Build DeSoto's V-8 Engines
 - p. 150, Magazines and Hoppers Expedite **Production and Inspection**
- p. 189, "Iron Hands" Make Press Operation Feb. Safer and Increase Production

TAY CF I		146,	Precision Control—A Must for Se-			1954
Lun		167	curity Threading Pipe Fittings on Auto-	Jan.	p. 166	, Magnetic Tape Programming of Ma- chine Tools
Jun	е р.	101,	matic Machines		p. 191	, Boring and Grinding Machine Main-
	p. 1	180,	Hopper Feeds for Bottle Caps			tains Work Concentricity
Sep	p. 1	151,	Ford's Improved Methods of Manufacturing Connecting-Rods		p. 213	, Automated Assembly of Aircraft Engines
Dec	p. 1	192,	Impacting — An Important New Method of Metal Forming	Mar.	•	Producing Chrysler's PowerFlite Transmission
					p. 165	Punch Press Controlled by Electronic Brain
			1953	Apr.	p. 163	, Ford Benefits by Tool Standardization
Jan.	p. 1	151,	Huge Mechanical Press Speeds Production of Steel Cartridge Cases		p. 224	, Unique Mechanism Reloads Cam- shafts in Nine Seconds
	p. 1	161,	Pneumatic Systems in Machine Design and Control		p. 229	, Electromechanical Spot-Drilling Reduces Costs
	p. 1	176,	Designing Hopper Feeds for Bottle Caps	May	p. 212	Machine Tool Electrification Forum Concentrates on Automation Prob-
Feb	p. 1	184,	Designing Hopper Feeds for Bottle Caps	June	p. 163	lems , Transfer Machining of Armored
Mar	. p. 1	152,	How Buick Builds V-8 Engines		1.00	Vehicle Hulls
	p. 1	164,	New Horizontal Presses Eliminate Lost Motion in the Production of	7 1		, Automatic Percussion Welding Speeds Contact Assembly
	p. 1	184,	Cartridge Cases Automaticity Can Increase Your	July		, Automation Applied to Crankpin Grinding Machines
May			Drilling Production Conveyor for Handling 250 Tons of	Aug.	p. 176	, Assembled Electric Motors Painted Automatically
			Scrap per Day Machining Techniques in a New	Sept.	p. 163	, Loading Devices Speed Gear-Shaving Production
Jun	•		Tractor Engine Plant	Nov.	p. 160	, Modern Tooling Produces Pontiac's New V-8 Engine
	p. 1	,	Handling Automotive Engines Automatically During Balancing		p. 178	Assembly Machines Speed Output of Automotive Accessories
Aug	. p. 1		Broaching Automotive Castings at 200 Feet per Minute		p. 184	Ford's New Methods of Forming and Machining Chassis Parts
	p. 1		Cold-Heading and Grinding Valve Push-Rods for Buick Engines		p. 232	, Automation Applied to Bearing Assembly
Sept	. p. 1	168,	Automation in Broaching	Dec.	p. 155,	Automation Accelerates Packard V-8
Nov	p. 1		Producing Chevrolet's High-Compression "Blue Flame" Engine		p. 169,	Engine Production Compact Transfer Machine Drills
	p. 1		Producing Automotive Accessories by Cost-Cutting Methods		p. 174,	and Taps Typewriter Castings Modern Tooling Produces Pontiac's
	p. 1		Piston Production at Ford Features Automation and Quality Control		p. 192,	New V-8 Engine Sectionized Automation—A Major
	p. 2	202,	Automation Increases Production of Stampings at Oldsmobile		p. 212.	Advance in Transfer Machining Mill for Rolling Bars, Rods, and
	p. 2	210,	Automatic Chip Processing Pays Dividends at Chrysler			Strips 1955
Dec.	p. 2	201,	Oscilloscope Reduces Cost of Jig Grinding Operations	Jan.	p. 201,	Crankshaft-Pin Grinding Made Completely Automatic



Milling Integrally Stiffened Spars on 308-Foot Machine

REVOLUTIONARY concept has been applied to the spar milling of parts for the Navy's "Warbirds" at the Torrance Plant of the Douglas Aircraft Co., Inc., through the use of a Farnham machine 308 feet in length. This "Long Mill" is equipped with eight integrated carriages having automatic cycling devices that control sixteen cutting heads. Although this machine is the largest of its type in the world, mere capacity alone was not the determining factor in its construction. It is a projection from the past into the future, best illustrated by the old-fashioned method of using belts on a lineshaft to power a long row of machinery of which the individual machines could all be run at the same time, or, only as required. So it is with the Farnham "Long Mill." In effect, the machine is the equivalent of eight spar mills, each as long, but not longer, than required for the work to be performed.

Each carriage on the bed operates individually within the space required for the job. Thus a number of either identical or dissimilar parts can be strung end to end on the bed and machined in rapid succession. An overhead crane that runs the length of the machine can pick up a carriage from any position and leap-frog it into any other position on the bed. When the carriage is connected to the parallel power supply, the carriage is ready for the performance of an operation.

There are two types of carriages—a straight and a swiveling, or "twist," design. Both types are

Fig. 1. One of the twist carriages on the Farnham "Long Mill" which can be tilted within arcs of 15 degrees either side of vertical.



equipped with milling heads driven by two 40-H.P. motors that run at 3600 R.P.M. They are designed to stand a 100 per cent overload for thirty-minute periods. The mist-lubricated and air-cooled bearings on the milling heads are designed to take the thrust of high-helix cutters in both directions. The twist carriages are identical in operation to the straight carriages, but can be swiveled 15 degrees each side of vertical, as seen in Fig. 1, and illustrated diagrammatically in Fig. 2.

Each cutter head on either type of carriage

is independently tracer-controlled, both vertically and horizontally, on straight carriages, and at angles on twist carriages. This tracer mechanism is hydraulically actuated. The templates are of a patented helical packaged type, composed of developed aluminum fins 1/8 inch thick, such as illustrated in Fig. 3. These fins are permanently mounted on aluminum Tenzaloy drums which are mounted on the sides of the carriages, as seen in Fig. 4, above the cutter heads. Each packaged template is identified by the part number of the piece it will produce. The

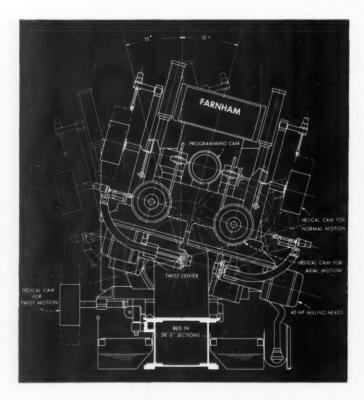


Fig. 2. Diagram of a twist carriage which indicates the swiveling range that enables milling to be performed at various angles.

template drum is geared to the carriage movement and rotates in constant contact with the hydraulic tracer.

When not in use, the packaged template is removed without disassembly within two or three minutes. It is stored in identified wooden boxes with the corresponding tooling in an area adjacent to the machine, as seen in the background of the heading illustration. The packaged templates eliminate errors of set-up and guesswork so common when templates are of the assembled type carried on the bed of conventional spar mills. Since each template controls the complete movement for the corresponding work-piece, there can be no loss of mating template parts that might necessitate new tooling.

By pressing one control button, the complete operational cycle of any carriage is set in action, the coolant pump starting first. The operation ends with the stopping of the spindle and shutoff of air for spindle lubrication and chip removal. Emergency stop-buttons are provided on both sides of the carriages to bring all operations immediately to a halt if necessary. Manual control can be substituted for automatic if desired.

There is a chip trough on each side of the 308-foot long bed. The troughs lead into flumes where the chip-laden coolant cascades to a filtering unit. The chips are reduced in size by a crushing machine to facilitate briquetting. The filtered coolant is channeled into a return trough that parallels the length of the entire bed. An intake on each carriage is submerged in this clean trough for feeding coolant to each head by

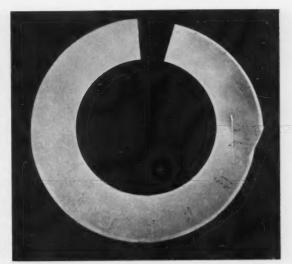
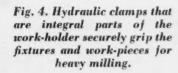


Fig. 3. A developed aluminum fin which, when assembled, will become part of the helical packaged template.

means of a pump. Coolant is delivered at the rate of 150 gallons per minute.

The company's El Segundo tool engineers designed the entire tooling requirements above the hardened steel ways of the basic bed. The subbase of the machine is of a universal type capable of accommodating any kind of work-fixture necessary to hold a part securely during milling. The sub-base is divided into 4-foot units that carry their own hydraulic valves for clamping





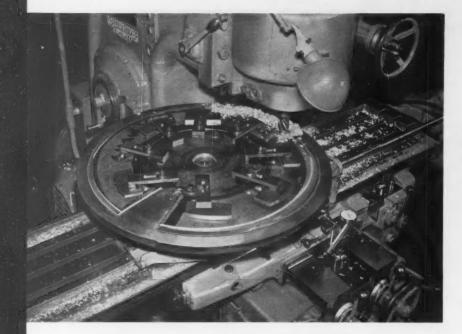
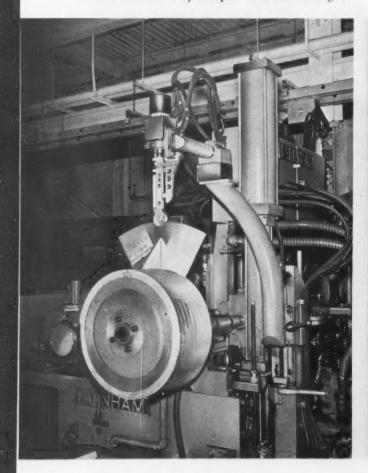
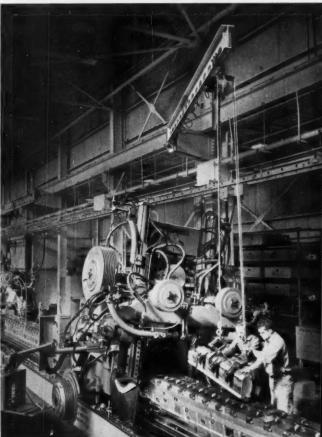


Fig. 5. Contour-milling one of the segments for a spiral cam to be mounted on a carriage of the "Long Mill."

Fig. 6. Master set-up cam employed to coordinate the location of the part and the carriage.

Fig. 7. One of the small overhead cranes used to install cams and fixtures on the "Long Mill."





208-MACHINERY, March, 1955

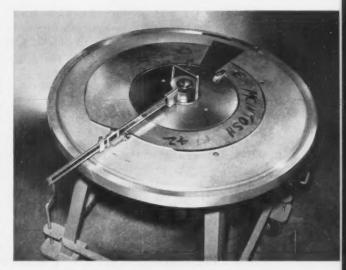
Fig. 8. Each segment for a spiral cam is inspected on a fixture to determine its accuracy with respect to the tool drawing.

purposes. Interconnected by links as desired, any number of multiple sub-base units in increments of 4 feet can be actuated through one lever. Each work clamp is valve-controlled so that the carriage itself can trip the valves. This permits use of "flying" clamps.

The work-holder unit of Meehanite, which is mounted on the basic bed, was designed and fabricated in the Torrance Plant. It is 288 feet long and composed of seventy-two 4-foot sections. It has more than two miles of hydraulic lines which are fed from two pumps having a capacity of 50 gallons per minute each. There are 1200 hydraulic cylinders on the work-holder unit, 600 cam valves, and 216 hand valves, together with over 500,000 other detail parts. After assembly on the machine bed, the 18-inch wide surface of the work-holder unit was machined to insure parallelism with the ways of the machine. Cutters for this purpose were mounted on one of the milling carriages of the machine itself.

The milling fixtures, as well as the production parts, are held securely by hydraulic clamps which are integral with the work-holder, as seen by referring again to Fig. 4. These clamps are quickly adjustable to suit fixtures from 6 to 15 inches wide. Any one of the eight carriages may be coordinated quickly to the part being machined by moving the carriage until the center line of the spindle is directly over the center line of a cross keyway in the work-holder and turning the cam-drive by hand until the cams are in the zero position. This is accomplished by means of a master cam on the packaged units already described, a typical master cam being seen in Fig. 6.

After the master cam has been set to zero, the cams and work-fixtures are installed by means of small overhead boom cranes located at various points along one side of the machine, as seen in Fig. 7. The spiral cams are individually machined to pre-calculated dimensions on a vertical milling machine equipped with a rotary table, Fig. 5, which has a low lead attachment. The design drawing for each cam gives the lead, as well as the change-gears needed to obtain the desired lead on the cam, for the convenience of the toolmaker. Individual cam segments are checked with the tooling drawing in the manner illustrated in Fig. 8, and are again inspected with the equipment seen in Fig. 9 after assembly on the drum, in order to insure the utmost accuracy.



Cutters used for production parts are made with two carbide inserts having a 25-degree helical angle and a 15-degree positive rake angle. Ground properly and balanced both statically and dynamically, these cutters will give a finish of 63 micro-inches r.m.s.

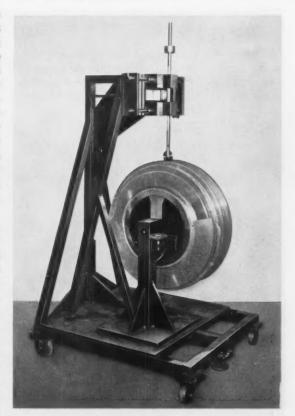


Fig. 9. Final cam inspection of the assembled spiral cam drum is accomplished with the equipment shown.

At least 80 per cent of the work-pieces handled on this machine are milled in both forward and reverse directions. This is accomplished by providing a cutter that has both a right- and left-hand cutting section. For the reverse cut, the cutter-spindle is reversed and a horizontal cam moves the cutter over so that the opposite portion of the cutting teeth only comes into contact with the work-piece.

To accomplish this, the cams are assembled in such a manner that at the extreme end of the carriage travel, the grooved cam follower runs past a switch designed somewhat similarly to a railroad switch. On the reverse cut, the cam follower rolls over on a different cam that is assembled between the segments of the cam used during the forward movement. This arrangement permits operations to be performed complete with one carriage which normally would require the passage of two carriages over the work

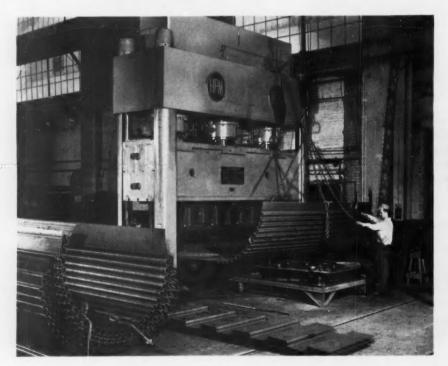
To attempt to duplicate the work possibilities of the "Long Mill" with individual spar mills would have been more expensive in initial cost and also in tooling. With the big machine, integral spars can be multiple-milled in one set-up, promoting more efficient operation, greatly reducing handling, and holding work space to a minimum. A final advantage is an even flow of work through the spar-milling department.

Corrugating Steel Plates up to 1/2 Inch Thick

ANNEALING-BOX covers are produced in a variety of shapes and sizes by the National Annealing Box Co., Washington, Pa. Some of them are cylindrical in shape, and others, rectangular. The walls of these containers are corrugated for strength and stiffness, as well as to hold their shape under the repeated heating and cooling cycles they undergo in service. Steel plates up to 1/2 inch thick are employed in making these covers.

A heavy press is required to form the corrugations, some of which have rounded contours, while others are right-angle bends with only small rounded corners. To form the corrugations, the concern uses the H-P-M 1500-ton hydraulic press, shown here, which accommodates plates up to 180 inches wide. The corrugations are formed one at a time as the plate is indexed through the die.

In the set-up illustrated, a semicircular section for a cylindrical cover is being formed from 1/4-inch steel plate. The corrugations are well-rounded and are about 2 inches deep. Completely formed half shells are seen at the left of the press. In the center foreground are narrower plates for rectangular boxes. On these parts, the corrugations are formed with flat sides and have right-angle bends.



Corrugating large steel sheets for annealing-box covers on a heavy hydraulic press

INGENIOUS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

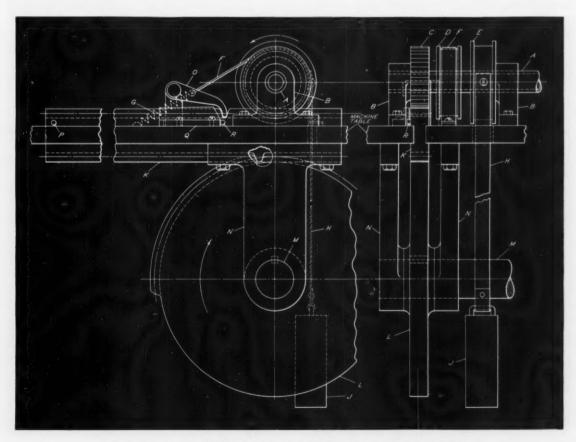
Intermittent Rotary Movement with End-Cycle Reversal

By L. KASPER, Philadelphia, Pa.

On a machine for forming a product of flat wire, the material is fed intermittently through a twisting clamp. At each of several pauses in the wire feed, the twisting clamp is given a full revolution and then comes to rest. The wire is then advanced to a new position, continuing in this manner until the required number of twists have been formed. After this, the twisting mechanism returns to its original position to complete the cycle.

In the diagram, tubular spindle shaft A, which carries the twisting clamp, is supported by bearing brackets B. Pinion gear C, brake-drum D, and counterweight drum E are keyed to shaft A. Friction is applied to the brake-drum by leather band F which is under tension applied by spring G. The counterweight drum receives steel strap H, to which the counterweight J is fastened. This serves to return the tubular shaft A to its initial position at the end of each cycle. The purpose of the leather band is to control the speed with which the counterweight descends.

A rack K, with teeth cut on both upper and lower surfaces, meshes with pinion gear C on the



Mechanism that provides intermittent rotary movement from a rotating drive-shaft, and which has provision for automatic reversal upon completion of operating cycle

top and gear segment L on the bottom. The rack is mounted on the machine table in such a manner that it is free to slide back and forth. Gear segment L is keyed to the drive-shaft M, which, in turn, is supported by bearing bracket N. The number of teeth in gear segment L is such that the motion it imparts to the rack in one revolution, will also rotate pinion gear C one revolution. A pitch diameter ratio of 4 to 1 exists between gears L and C; therefore, their rotative speeds are in the same ratio. Due to the segmentation of gear L, however, the ratio of revolutions between this gear and the rack-driven pinion gear C is unity.

The diagram shows the mechanism at the beginning of the cycle. Referring to the front elevation at the left, the first tooth in gear L, which is rotating in the direction indicated by the arrow, has made contact with the gear teeth on the under side of rack K. This causes the rack to move to the right, thereby rotating gear C in a counter-clockwise direction. Drum E, being keyed to spindle shaft A, also rotates, thus causing counterweight J to rise as steel strap H is wrapped around the drum. After the last tooth in gear L has disengaged the teeth in the rack, gear C stops turning and the rack is held in position at this point by pawl O. The pawl drops between two of the upper rack teeth.

The spindle shaft then remains stationary until the first tooth of gear L again contacts the teeth on the under side of rack K. This phase is repeated until pin P, attached to the rack, contacts sliding dog Q, moving it to the right. This raises pawl O out of contact with the teeth in rack K. The action of counterweight J then causes a reverse rotation of pinion gear C, which, in turn, drives the rack to the left. Pawl O remains raised until pin R contacts sliding dog Q, moving it to the left, and allowing the pawl to drop back into contact with rack K, thus completing the cycle. The twisting clamp carried by shaft A is not shown.

Lever Type Driving Mechanism Permits Stroke and Dwell Adjustments

By W. M. HALLIDAY, Southport, England

The lever type mechanism illustrated was incorporated in the drive of a wrapping machine, and was required to operate a transfer slide which transported wrapped packages from the machine to a conveyor belt alongside. A drive-shaft with an oscillating rotary movement, restricted to a 35-degree rotation, was the source of motion for the driving mechanism. Another factor involved in the reciprocation of the trans-

fer slide was that it had to be readily adjustable to suit the various sizes of packages normally handled by the machine.

Drive-shaft A, shown at X in the illustration, is mounted horizontally within a bearing hole through the small upright boss B. This boss is an integral part of the cast-iron base C. Four bolt holes are drilled through the base.

Securely keyed to the drive-shaft are two identical levers D, one being situated at each side of boss B. They are retained in position by means of the headed end E of the drive-shaft at the right-hand side, and collar F, cross-pinned to the shaft, at the left-hand side.

Pin G, which supports lever-arm H, passes through in-line holes in the upper end of the twin levers D, and is retained by collar J. The upper limb of the lever-arm pivots on pin K within the forked end of connecting-rod L. This connecting-rod is linked directly to the transfer slide of the wrapping machine. The lower limb of the lever-arm is at a slight angle with relation to the upper limb, and is slotted to receive the end of rod M. A pin N joins these two members so that they are free to pivot.

The opposite end of rod M is a sliding fit within trunnion block O. A shaft, machined on one side of the block, rides in a bearing hole in large boss P, which, in turn, is cast integral with base C. Collar Q is pinned to the shaft to retain the trunnion block in position.

For the major portion of its length, rod M is threaded to receive four knurled nuts R, which are located as shown. The nuts are adjustable, and are normally secured in any desired setting by simply locking them together in pairs.

The diagram at the right-hand side of *X* shows the relative positions assumed by the various components as drive-shaft *A* starts to move in a counter-clockwise direction.

At this point in the cycle of operation, connecting-rod L is in its retracted position, that is, situated 4 inches to the right of vertical axis X-X. It will be observed that levers D are inclined at an angle of 25 degrees to the right of the same axis.

Distance S must be calculated according to the duration of the dwell period required at each end of the stroke. In the illustrated example, this distance is regulated so that the connecting-rod and the transfer-slide will remain inactive at each end of the stroke during a 5-degree travel of shaft A.

As the mechanism moves from its starting point in the direction of the arrow, connecting-rod L remains stationary due to the resistance of the transfer slide. This will continue until the levers D have completed the preset 5 degrees of movement, whereupon knurled nuts R, at the

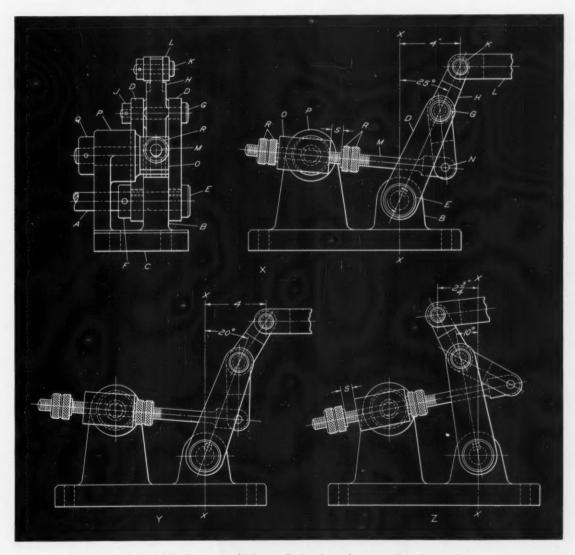
right of the trunnion block, will contact that member, as shown at Y in the illustration. No motion has thus far been imparted to the connecting-rod.

As the drive-shaft continues its movement beyond this point, rod M is prevented from sliding any further to the left. Thus connecting-rod L receives the combined movements of levers D and lever arm H. This action may be visualized by referring to diagram Z in the illustration. The diagram shows the relative positions of the components when drive-shaft A has reached the end of its forward oscillation. At this stage, levers D are inclined 10 degrees to the left of vertical axis X-X, while the connecting-rod has moved $2 \, 3/4$ inches to the left of the same axis, a total travel of $6 \, 3/4$ inches.

As the return stroke commences, the connect-

ing-rod again remains stationary, due to the resistance of the transfer slide, for the first 5 degrees of drive-shaft travel. After this distance has been covered, the knurled nuts R, on the left-hand side of the trunnion block, reach their limit of movement, at which time motion is once again transmitted through the connecting-rod to the transfer slide of the machine.

Duration of the dwells at each end of the stroke may be altered by adjusting the setting of the knurled nuts on rod M while the machine is operating at slow speeds. The nut-setting may also be altered to effect variations in the points of reversal of the stroke. By setting both pairs of nuts in contact with the end faces of the trunnion, the dwell periods will be eliminated and the connecting-rod will have its maximum length of stroke.



Knurled nuts of the lever type driving mechanism here shown may be adjusted during operation to vary the dwell duration and also the points of connecting-rod reversal.

TOOL ENGINEERING Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Hobbing Worm-Gears on a Milling Machine

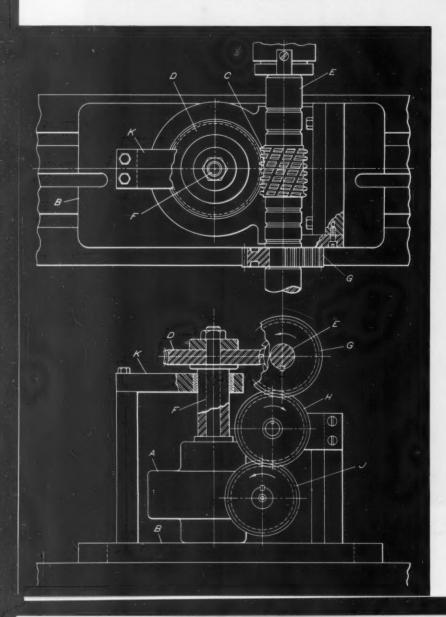
By H. J. GERBER, Stillwater, Okla.

In the absence of other equipment, wormwheels can be efficiently hobbed on a horizontal milling machine equipped with a special speed reduction unit. The unit A, set up on the base Bof a simple fixture, has the proper gearing ratio to control the relative speeds of the hob C and the worm-wheel blank D. The hob is mounted on the arbor E of the milling machine, and the blank is keyed to an adapter F connected to the wormgear shaft of the speed reduction unit. It will be noted that the blank is located so that its periphery intersects the center line of the hob.

Also mounted on the arbor is a driving spur gear G. This gear meshes with an intermediate

idler gear H supported on the fixture, which, in turn, meshes with driven spur gear J on the end of the worm-shaft of the unit. Gears G and J must be the same size, but the size of gear H is not significant. The distance between the arbor and the wormshaft will, of course, be completely dependent upon the diameters of the gears selected.

To initiate a work cycle, the table of the milling machine is fed to the right to bring the blank into contact with the revolving hob. Although gears G and H will not be in full mesh until the hob operates at its full depth of cut, this is no hindrance to the proper functioning of the device. It may, however, be necessary to select gears having a relatively small diametral pitch number to assure partial contact before the hob begins to cut. Usually, it is necessary to provide a support arm K for the adapter. The purpose of this arm is to prevent deflection of adapter F under load by absorbing the in-feed thrust of the cut.



Gear train and speed reducer permit worm-wheels to be hobbed on a horizontal milling machine.

214-MACHINERY, March, 1955

Automatic Die Stop

By FEDERICO STRASSER, Santiago, Chile

A high production rate is attainable when an automatic stop arrangement using a notching punch is incorporated in the design of a punch and die. Such a device makes it possible to utilize every stroke of the press for blanking, regardless of the speed at which it is operated. This automatic stop may be used in blanking, progressive, compound, and other types of dies in which the work-pieces are cut from either coils or strips.

A typical installation of this stop in the stock guide of a three-station progressive die may be seen at X in Fig. 1. The die is used for the production of rectangular components such as the one shown at Y. A strip, slightly wider than is absolutely necessary, is fed into stock guide A until it strikes shoulder B. The press is then actuated to pierce the three round holes at the first station. Simultaneously, notching punch C reduces the width of the strip along a length equal to the pitch, or distance between station centers. This again provides a shoulder, which, when the material is advanced, will register against shoulder B in the stock guide.

When the press ram descends for the second time, the rectangular opening is punched in the first part while the three holes are pierced for the second part. The notching punch also trims the next portion of the strip. After once again feeding the strip up to the stop and actuating the press, the first part is blanked out, the second part is punched, three holes are pierced for the third part, and the strip is trimmed by the notching punch.

Since the shoulder in the stock guide serves as a stop, it constantly receives impacts from the strips being fed into the die. This action tends to wear away the surface of the stop. To avoid this, a small dovetailed insert D, of hardened tool steel, may be placed in the stock guide E as shown at W in Fig. 2. Notching punch F rides in a groove machined in the insert. In case of excessive wear, the insert may be replaced.

A rectangular type insert G is illustrated at X. This insert fits into a recess in the stock guide and is staked in place by dowel-pin H. The dowel-pin is pressed into place so that half of it extends into the insert, and half into the guide.

The use of an insert may be eliminated entirely if the trimming or notching punch is supplied with a supplementary part. Such a condition may be seen at Y. Part J serves as the stop and fits into a elongated opening in the guide plate. The stop is supported at all times in this way regardless of the press ram position. Punch K fits into the same elongated opening as does the

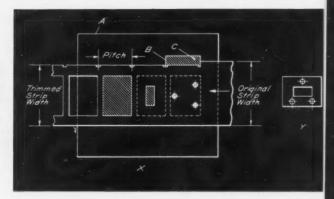


Fig. 1. An automatic stop arrangement is incorporated in the three-stage progressive die shown at (X) which produces the component shown at (Y).

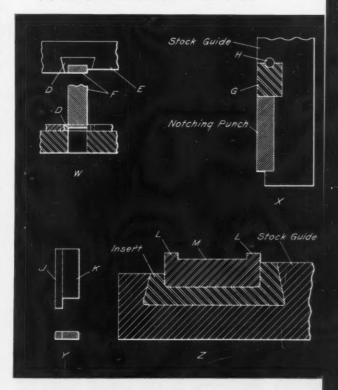


Fig. 2. Two types of die-stop inserts, top, may be replaced when worn. The single unit at (Y) combines die stop and notching punch. Punch at (Z) notches strip to prevent burrs and sharp edges.

stop, but clears the guide when the press ram is at its uppermost position.

The two projections *L* on the trimming punch *M* shown at *Z* are not absolutely necessary, but they are, nevertheless, highly recommended. Their purpose is to cut notches along the edge of the trimmed strip to avoid the formation of sharp burrs. Not only may the presence of burrs hinder the advance of the strip, but they also are a hazard to the safety of the press operator who must handle the strips.

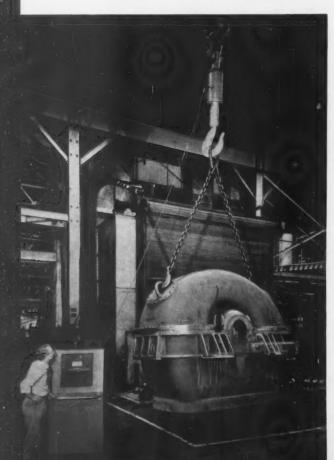
Fig. 3. An adjustable wedge permits re-feeding the strip through the die in an inverted position, in order to obtain the maximum number of parts.

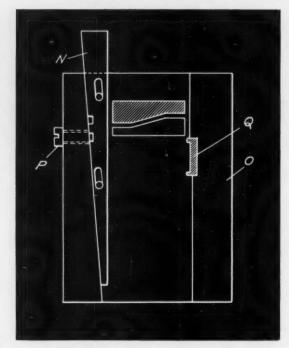
A set-up in which the same strip may be fed through the die twice in order to obtain the largest number of pieces possible (the second pass using the strip in an inverted position) is shown in Fig. 3. An adjustable wedge N forms the left-hand side of the stock guide O. This wedge may be locked in either one of two positions by a set-screw P. The difference in the width of the guide channel resulting from movement of the wedge must correspond exactly to the width of the metal trimmed off by punch Q.

Electric Crane Scale Reduces Weighing Time

Costs of weighing huge parts for turbines, generators, and propulsion gears before shipment from General Electric Co.'s River Plant in West Lynn, Mass., were reduced 10 to 12 per cent following installation of an electric crane scale of 50-ton capacity. Time savings of at least 20 per cent were obtained for an average of eight weight operations per day.

The pick-up unit consists essentially of a tension type load cell of 100,000 pounds capacity





with a clevis at the top end to put over a crane hook, and a hook at the bottom end to pick up the load. A Baldwin weight indicator and two electrical cable reels are mounted on a dolly. An 80-foot cable connects the indicator with the pick-up unit, and the electric cord on the other reel is used to connect with an electric power outlet.

The crane scale is portable and can be used on any of nearly 100 cranes in the plant. Hoisting pieces weighing more than 15 tons on a flat car or trailer, hauling them to a track scale about 0.4 mile in the rear of the plant, and then hauling them back again has been eliminated.

One of the several conveniences provided by electrical weighing is the fact that tare weight, which varies considerably from one weighing to the next, can be zeroed out by turning a knob on the Baldwin load indicator before picking up the load. The indicator then reads directly in net pounds of load, not including chains or other supporting accessories. Weighing accuracy is within 0.2 per cent for loads above 15 tons. The scale is graduated in 200-pound divisions and can be read to 50 pounds. Loads over 50 tons can be determined with the crane scale by supporting the load on two crane hooks. The 50-ton crane scale is the largest of a new line of SR-4 crane scales made by Baldwin-Lima-Hamilton Corporation.

Weight of a turbine assembly, supported by electric crane scale pick-up unit, is read directly in pounds on the portable indicator to which it is connected by a cable.



By BERNARD LESTER
Management Consulting Engineer

How to Capitalize on the Machine Tool Show

T HE ultimate results from the coming Machine Tool Show and other shows for the metal-working industry, which will run concurrently in Chicago next September, will depend upon how well sales managers plan to meet this unequalled selling opportunity. Eight years have passed since the last machine tool show. The year 1947 marked a faltering market due to war termination, whereas 1955 marks an expanding economy characterized by new ideas concerning products and processes. It is a time when our potential market has reached an all-time high, due to growing obsolescence of manufacturing equipment, intense customer competition, and the relative abundance of funds for capital outlay.

The chief burden of promoting new machines and equipment rests upon the sales manager and his associates. Planning and execution must match the remarkable opportunity of the coming shows. Too many exhibitors think of what they might have done when it is too late and then regret their mistakes.

Maximum sales from any show can be anticipated only if products and services are effectively presented. Exhibiting is just one part of selling. Prospects and customers come to see the sellers—which is an indication that an interest exists. It must be intensified to create sales. The ingenuity and skill of every supplier will be challenged by the exhibits of all competitors.

The Exhibit. Any exhibit reflects the character of the exhibitor. To be successful it should have unity, distinctiveness and appeal. Its whole aspect must be inviting.

What to Exhibit. Feature, of course, that which is new. Don't illustrate huge equipment by pictures and words only. Operating models are particularly desirable. Remember to emphasize company facilities and services.

How to Exhibit. Consider most carefully space utilization. Exhibits crowded with equipment do not provide space for observers. Illustrate quality, adaptability, speed, accuracy, and other advantages of equipment. Interpret fiscal results. Noisy displays attract crowds, but they have serious drawbacks in reaching the right people.

Manpower at the Exhibit. Analyze every question the prospect might ask, and train the sales engineers who man the exhibits to answer them. Be prepared to furnish the prospect with information he can bite into and chew, not just taste. Suggestions that can help prospects solve their problems count more than promotional material.

Record Prospects and Problems. Inquiries require careful and complete recording—who made each inquiry, what was it about, and where does the inquirer work. After all, the value of any exhibit is largely lost unless every prospect is followed up promptly.

New Ideas for the Equipment Builders. Every show is not only a chance to sell but a chance to learn. Train sales engineers to record new ideas which will lead to improvements in the machinery sold. To learn of new ideas should be a vital purpose in exhibiting at shows.

Company Resources. No sales department can meet alone the peak of opportunities presented at the show. Home office engineers, manufacturing and purchasing personnel can render invaluable help in doing a selling job. The wise sales manager solicits such personnel and guides them in the part they play in company representation.

Installation. Who hasn't attended a show and found some exhibit incomplete or not in working order? It is like attending an illustrated talk where the projector doesn't work. Planning every detail, trying everything out beforehand, and providing for emergencies are all essential.

LATEST DEVELOPMENTS IN



High-Speed Gear-Hobbing Machine Equipped with Automatic Controls

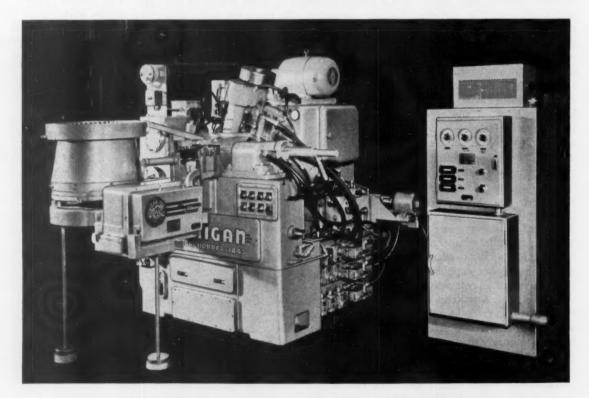
The Michigan Tool Co., Detroit, Mich., has brought out a high-speed hobbing machine equipped for automatic production of helical and spur gears within specified size limits. Constant and accurate automatic checking of the gear size throughout the production cycle—synchronized with automatic adjustment of the center distance between the hob and the gear blank—compensates for size variations due to tool wear or to changes in temperature. Gear blanks placed in the hopper type

loader are rapidly and automatically discharged as accurately sized gears. All gears produced are checked for size by the "3-Way Gear Classifier." Any variation from pre-set tolerances resulting from tool wear, or other causes, is immediately detected by the classifier and the proper signal is relayed to the gear controller unit.

The controller unit automatically adjusts the center distance between the hob and the gear blank so that the gear sizes are kept within specified tolerances.

The controller unit also provides a statistical record of production, including the number of gears rejected and the total production. When the predetermined number of gears has been produced the controller shuts down the machine. Should the helix angle fail to meet specifications at any time, the controller stops the machine.

Once the hobbing machine is set into motion, the only manual operation normally required of the attendant is to keep the automatic loader full of gear blanks. Should



Michigan automatic spur and helical gear production unit consisting of hopper type automatic feeder, ultra-speed hobber and three-way gear classifier

Equipment Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

the machine be stopped automatically, a light on the controller panel flashes, and the operator merely checks the controller counters to

determine the cause. Shut-downs by the hob shifter indicate that the hob requires sharpening. Circle Item 101 on postcard, page 257

Michigan Automatic Machine for **Processing Transmission Cases**

The Michigan Drill Head Co., Detroit, Mich., has brought out an automatic machine designed to tap the holes in all six sides of transmission cases for farm tractors at a production rate of forty cases per hour. The processing operation

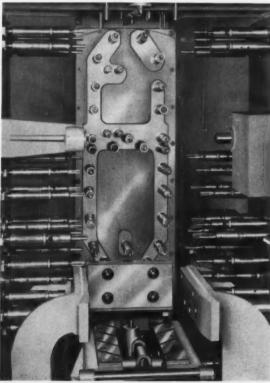
consists of tapping a total of ninety-seven holes in each one.

As the work enters the machine from a roller conveyor, a switch is actuated to start the cycle which includes locating and clamping the work, moving the tapping unit into position in front of the work, and starting rotation of the tapping

There are six tapping units, one for each side of the transmission case. The front unit has four spindles; the bottom unit, ten spindles; and the right-hand unit, twentyone spindles. The left-hand unit has twenty-two spindles; the top unit, eight spindles; and the rear unit, thirty-two spindles. All spindles are of the individual leadscrew and nut type and are individually lubricated. The taps are lubricated by a coolant system.







units of automatic machine shown in Fig. 1.

When the tapping operation is completed, the work is automatically unclamped, the locators retracted, and the front tapping unit

returned to its original position to permit removal of the processed transmission case.

Circle Item 102 on postcard, page 257

Cincinnati Cutter and Tool Grinder

The Cincinnati Milling Machine Co., Cincinnati, Ohio, has just announced a No. 1 cutter and tool grinder designed primarily for reconditioning miscellaneous small tools and cutters. The machine has a swing capacity of 8 inches and will take cutters up to 15 inches long. The grinding wheel spindle has double row special pre-loaded cartridge type anti-friction bearings, packed in grease for lifetime lubrication.

A reversible 1/2-H.P. motor drive, built into the wheel-head, provides for rotation of the grinding wheel in either direction. A spindle speed of either 6260 or 3730 R.P.M. is obtained by means of a tooth-grip belt and sheave arrangement.

Grinding wheel collets can be

quickly interchanged by removing a socket-head screw. An anti-friction slide provides for easy table movement. Duplicate controls permit the machine to be operated from the front, right-hand end of the table; or at the rear, right or left-hand side of the wheel-head.

An interesting feature is the provision for a 360-degree eccentric wheel-head swivel movement. This adds 3 inches to the conventional cross range travel of 4 1/2 inches and facilitates surface grinding operations. It also assures ample capacity for grinding cutters requiring the full 8-inch swing capacity of the machine.

A "Tange Bar" taper setting device enables the operator to quickly position the swivel table with a higher degree of accuracy for grinding angular cutters and tapered reamers. The double-end anti-friction spindle of the universal work-head accommodates No. 12 B & S (No. 5 Morse optional) taper shanks on one end and No. 50 Series National Standard on the other end. Dials on both the work-head and left-hand tailstock permit settings to be made for clearance angles.

Electrical controls are recessed in a compartment at the front of the machine. A disconnect switch shuts off the current when the compartment door is opened. An additional safety feature for shops operating on high voltages reduces the voltage to 110 at the push-button station.

A wide variety of attachments extends the range of the machine for sharpening small cutters. Surface and internal grinding attachments, gear cutter sharpening, radius grinding, differential table traversing attachments, and an indexing unit for the universal work-head are also available.

Circle Item 103 on postcard, page 257



Fig. 1. Cutter and tool grinder announced by the Cincinnati Milling Machine Co.

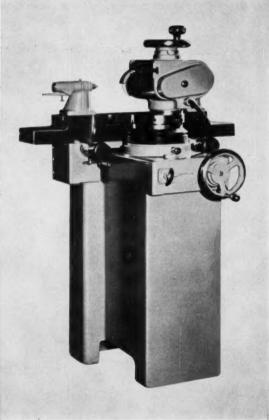


Fig. 2. Rear operating position of cutter and tool grinder shown in Fig. 1

Tangent-Arc Tool Grinder

The Union Twist Drill Co., Athol, Mass., has announced an improved No. 3 Tangent-Arc profile grinder developed to reduce set-up time to a minimum and to perform a wide variety of cutter sharpening and grinding operations. This machine will grind the profile clearances on the periphery, sides, or corner radii of cutter teeth. It can also be used to grind the radii on straight or spiral cutters, side- or face-milling cutters, angular cutters, ball-end cutters, and end-mills.

Convex cutters formed to any radius up to 2 1/2 inches can be ground for a full half-circle and to any radius up to 4 inches for an arc of 120 degrees. Concave cutters of any radius up to 5 inches and cutters with profiles composed of any combination of circular arcs and angles can also be ground. Arbor cutters up to 10 inches in diameter and a face width of 5 inches can be readily accommodated. Clearances can be

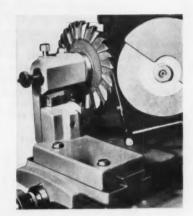


Fig. 2. Close-up of cutter-grinding set-up on machine in Fig. 1

ground on straight teeth or on spiral teeth of any helix angle up to 90 degrees, and for any length up to 5 inches.

The grinding wheel spindle has life-sealed precision ball bearings and is driven at a speed of 4600 R.P.M. by a 1/2-H.P. motor operating at a speed of 3450 R.P.M.

Grinding wheels from 4 to 6 inches in diameter and face widths of from 1/8 to 3/4 inch, with bores 1/2 inch in diameter can be used. The machine requires a floor space 44 by 24 inches, is 58 inches high and has a net weight of 900 pounds.

Circle Item 104 on postcard, page 257

G.E. Ultrasonic Generator for High-Frequency Cleaning Operations

A high-powered multi-crystal ultrasonic generator developed to make possible the construction of larger and more flexible industrial cleaning equipment of the high-frequency sound wave type has been announced by the General Electric Co., Schenectady, N. Y. This generator consists of two separate units: a power oscillator enclosed in a separate cabinet, and the transducer assembly which contains five quartz vibrating crystals.



Fig. 1. Tangent-Arc tool grinder of improved design announced by the Union Twist Drill Co.



General Electric multi-crystal ultrasonic generator for high-frequency sound wave cleaning applications

The transducers are hermetically sealed and can be placed directly into a tank of solvent at a distance from the oscillator. Thus, they can be easily incorporated into a regular vapor-degreasing or hot-dip process. The equipment is so designed that four transducers can be used with a single power oscillator unit. With this equipment ultrasonic tanks can be made for handling larger parts, or for continuous-process cleaning of small parts.

Circle Item 105 on postcard, page 257

Johnson & Bassett Cutter Grinder

A new compact, self-contained grinder for precision sharpening of single-flute milling or engraving cutters is announced by the Production Tool Division of Johnson & Bassett, Inc., Worcester, Mass. This Model MT-1100 cutter grinder requires a working space only 14 1/2 inches high in an area 15 inches square. Its built-in diamond wheel dresser is mounted on the wheel guard, allowing the wheel to be dressed without disturbing the tool-head. Four superprecision ball bearings serve to eliminate end play in the sealed spindle, and the sliding sleeve is dustproof.

The rocking head is accurately

controlled by a thumb-screw in the base. A plunger and dial in the tool-head provide for indexing cutters having one, two, three, or four sides or flats. The standard spring collet receives cutter shanks up to 1/2 inch in diameter. A special tool-head is also available for sharpening ball-nose and regular single-flute cutters.

Circle Item 106 on postcard, page 257

Kraus "Thru-Feeder" for Centerless Grinders

Kraus Design, Inc., Rochester, N. Y., has announced an automatic "Thru-Feeder" developed to facilitate the automation of machines used for centerless grinding operations on bearing races. The bearing races are delivered from hoppers with their axes parallel. A stacking device then arranges the parts with their axes aligned and feeds them into a dual pair of feed discs which carry the parts to the grinder work-rest by maintaining a constant and predetermined pressure.

The F-4 model will accommodate races or similar parts from 3/8 inch to 11/4 inches in diameter, while the F-7 will handle parts from 11/4 to 3 inches in diameter. Production rates are easily changed to suit the feed rate of the grinder.

Circle Item 107 on postcard, page 257



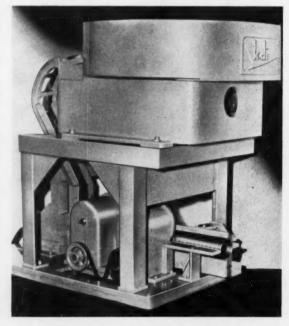
Van precision milling machine built by Simmons Industries

Van Milling Machine

Simmons Industries, San Francisco, Calif., has introduced a precision variable-speed vertical milling machine. One of the features is a gibbed over-arm with handwheel control. This arrangement assures easy, positive, and accurate in-and-out movement of the



Cutter grinder brought out by Johnson & Bassett Inc., for precision sharpening of milling or engraving cutters



"Thru-Feeder" developed by Kraus Design, Inc., for the automation of centerless grinders

over-arm. It also provides for increased cross-milling capacity.

The Van machine has eight spindle speeds ranging from 90 to 2500 R.P.M. when equipped with a 3/4-H.P. motor, and from 135 to 3750 R.P.M. with a 1-H.P. motor. The spindle is driven by a timing belt designed to eliminate belt slippage. The quill is 31/2 inches in diameter and has a travel of 4 inches. The maximum collet capacity is 3/4 inch, and individual tool-holders are available in capacities up to 1 inch.

Optional equipment includes mechanical power feed to the table—0 to 20 inches per minute—infinitely variable with instant reverse; a wide-opening toolmaker's vise; a side milling cutter arbor; and an extra long table. Hydraulic power feeds and special tooling for individual needs are obtainable, as well as semi-automatic or automatic controls.

Circle Item 108 on postcard, page 257

Peterson Wet Surface Grinding Machine

An automatic universal wet surface grinding machine designed for fast, accurate grinding of heads, manifolds, and cylinder blocks of automotive engines in a wide range of sizes and types has been placed on the market by the Peterson Welding Laboratories, Inc., Kansas City, Mo. This equipment is adapted for grinding all kinds of metals and alloys, and will accommodate work-pieces up to 16 inches wide, 64 inches long, and 24 inches high. Large work, including the largest size engine cylinder blocks, can be lowered straight down into the grinding position from an overhead hoist or crane.

The accompanying illustration shows the set-up for grinding heavy Diesel engine blocks. Set-ups employing aligning rails can be used for rapid, accurate grinding of V-8 and in-line engine blocks, manifolds, and heads. A built-in protractor permits fast,

accurate setting for lateral as well as longitudinal alignment.

An outstanding feature of the grinding machine is its capacity for taking a 0.010 inch cut. A cup or face type flat dressed grinding wheel 16 inches in diameter with an over-size 5-inch face is employed. The high cutting capacity of this wheel is made possible by a centrifugal force flush-coolant system. With this system the coolant is conducted to the wheel through a hollow motor shaft and hollow spindle.

The machine is 104 inches long, 53 inches wide, 93 inches high and weighs 3435 pounds. It is driven by a 5-H.P. motor operating at a speed of 1725 R.P.M.

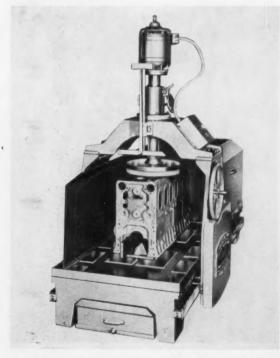
Circle Item 109 on postcard, page 257

Snyder Special Automatic Machine for Processing Automotive Differential Cases

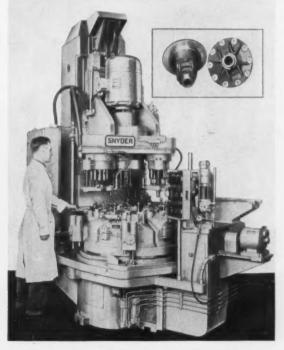
An automatic cycle, special machine for processing automotive differential cases is announced by the Snyder Tool & Engineering Co., Detroit, Mich. This five-station, vertical indexing type machine drills, spot-faces and reams ten flange holes in either of two similar malleable iron differential cases. The change from one part to the other is made possible

through the use of a fixture designed to facilitate adapter changes.

The work is manually loaded and hydraulically clamped at the first station, then it proceeds through the automatic cycle of drilling, spot-facing and reaming at succeeding stations. Unloading is accomplished automatically by means of cam-operated, scissors



Universal wet surface grinding machine introduced by the Peterson Welding Laboratories, Inc.



Automatic machine built by Snyder Tool & Engineering Co., for processing differential cases

type fingers which swing over the fixture, grip the part around the bearing hub, lift it out of the fixture and deposit it on a pair of rails beside the index table.

The high-speed steel tools run at a speed of 80 surface feet a minute, and at a feed rate of seven inches a minute. They are mounted in a vertical head which has a stroke of 15 inches and which is equipped with heat-treated and shaved gears. Tools and adjust-

able adapters with the tools preset for length can be interchanged as unit assemblies. The index table is hydraulically operated. Coolant is supplied from a tank beside the machine. Lubrication is manually controlled by a handle near the loading station. The machine can be run by unskilled labor for it is electrically interlocked to protect both operator and machine. Production is 220 pieces an hour.

Circle Item 110 on postcard, page 257

Burr-Master Machine for Chamfering Hypoid Pinions

A single-station Burr-Master machine designed for chamfering hypoid pinions is announced by the Modern Industrial Engineering Co., Detroit, Mich. This machine, Fig. 1, has a production rate of more than 250 pinions per hour, and two machines can be kept in operation by one unskilled attendant. The push-button actuated machining cycle is completely automatic and stops when the tools are retracted on completion of the cut. The chamfer is generated uniformly, eliminating all sharp corners well into the root of the tooth.

Pinions are inserted, shaft down, into the opening provided in the work station, see Fig. 2. The radial locator lever is actuated by the operator to make certain the part is properly located. This action energizes the clamping circuit and the part is then clamped by depressing a push-button. The machining cycle is started by means of two push-buttons, located on opposite sides of the machine for maximum operator safety. The machining time is five seconds and the floor-to-floor time is thirteen seconds.

An indicator light is automatically flashed on at the start of the machining cycle and goes off when the machine stops on completion of the work. A foot pedal used to eject the finished parts has a safety interlock which prevents

accidental depression while the machine is running. Changing the set-up for one pinion to that of another is quickly and easily accomplished.

The tools used for chamfering have been specially developed and are of the forming dovetail type. A stop is provided to facilitate resetting the tools after grinding. Cutting is done dry, no coolant being required. The depth of cut is readily adjustable for the single cutting stroke required to deburr and chamfer a tooth. Automatic indexing of the pinion takes place during the return stroke of the tools, permitting two cutting strokes per second. All electrical equipment is built to J.I.C. standards. A built-in chip disposal chute is provided and an automatic chip disposal unit is available if required.

Circle Item 111 on postcard, page 257

Edlund Sensitive Drilling Machine

A Model 1F sensitive drilling machine with speeds from 1250 to 10,000 R.P.M. brought out by the Edlund Machinery Co., Cortland, N. Y., has a Vari-Speed drive, micrometer graduated depth control, and sensitive spindle tension



Fig. 1. Burr-Master machine for chamfering hypoid pinions built by Modern Industrial Engineering Co.

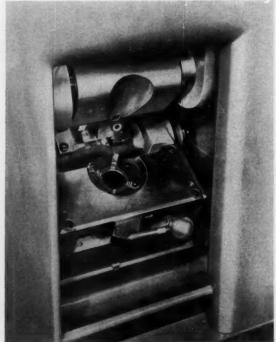


Fig. 2. Close-up of tooling equipment in Fig. 1 for deburring and chamfering typical hypoid pinion

Edlund sensitive drilling machine

adjustment. This machine is made in pedestal and bench models and with one to six spindle units. Circle Item 112 on postcard, page 257

Cleveland Inclinable and Double-Crank Presses

The Cleveland Punch & Shear Works Co., Cleveland, Ohio, has brought out two presses-an inclinable type, Fig. 1, and a doublecrank model, Fig. 2. The inclinable press has a capacity of 110 tons, is single-geared, and equipped with an electrically controlled, airoperated drum type friction clutch with spring-loaded brake. The flanged slide is air counterbalanced and is arranged with power adjustment. The flywheel of the machine is equipped with an air brake to bring it to a quick stop when the power is shut off.

The double-crank press, Fig. 2, has a capacity of 200 tons, a bed and slide area 48 by 60 inches, and a stroke of 12 inches. This press is of the double-geared, twin drive type. It is equipped with a single-station electrically controlled air-operated drum type friction clutch.

The slide and bolster have Tslots, and the slide, which has power adjustment, is air counterbalanced. The machine has a centralized mechanically operated lubrication system. The pneumatic cushion in the bed has a 6-inch travel and a capacity of 40 tons at an air pressure of 100 pounds per square inch.

Circle Item 113 on postcard, page 257

Carboloy Standard Tools and Blanks for Steel-Cutting Operations

The Carboloy Department of General Electric Co., Detroit, Mich., has added 117 new sizes to its line of standard tools and blanks for steel-cutting operations. These tools and blanks are available in Grades 350 and 370 carbide. Other new carbides include twenty sizes of Grades 883 and 44A carbide Style 0000 blanks for heavy-duty cast-iron and nonferrous cutting operations, throwaway type blanks in grades for steel and non-ferrous cutting applications, and standard Grade 883 and 350 carbide Style F and G offset tools in 1/2- and 5/8-inch sizes for ferrous and non-ferrous cutting and threading.

Circle Item 114 on postcard, page 257

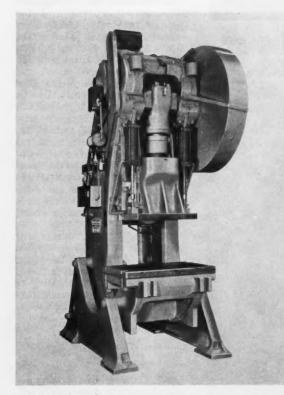


Fig. 1. Cleveland single-geared inclinable press with counterbalanced slide

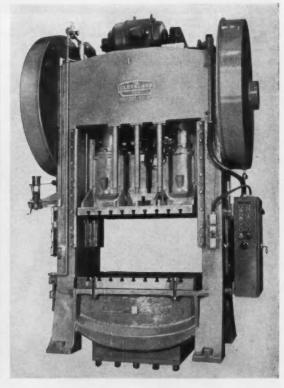


Fig. 2. Double-crank press introduced by the Cleveland Punch & Shear Works Co.

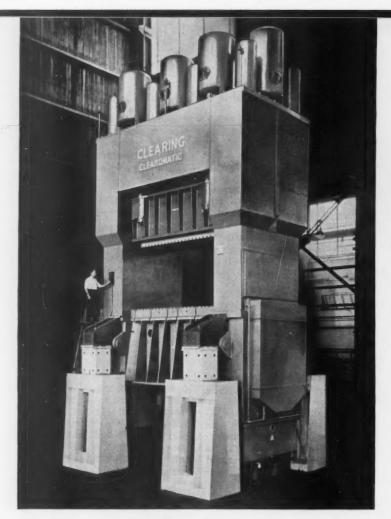
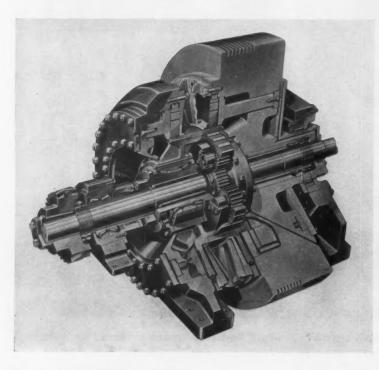


Fig. 1. Press developed by the Clearing Machine Corporation for rapid production of deep-drawn stampings



"Clearomatic" Deep-Drawing Press

The Clearing Machine Corporation, Division of U.S. Industries, Inc., Chicago, Ill., has brought out a press developed for rapid production of deep-drawn stampings or parts such as automobile fenders. The production capacity of this "Clearomatic" press, Fig. 1, has been considerably increased through the use of a newly developed clutch of the design shown by the cut-away view in Fig. 2. This clutch has a planetary gear system which makes automatic changing possible from high to low speed and from low to high speed without loss of flywheel energy.

At the beginning of the press operating cycle, the slide is driven downward by the high-speed unit of the planetary gear system. With this high-speed drive engaged, the ring gear, planetary gear assembly and the driving shaft rotate at the same speed as the flywheel. When the press slide reaches the predetermined point above the work, the high-speed driving unit is automatically disengaged and the drive shifted to the low-speed unit. This causes the driving shaft to be rotated at one-third the speed of the flywheel and thus reduces the downward speed of the slide during the drawing portion of the stroke which immediately follows.

The point at which the slow drawing speed begins can be changed by a simple adjustment in the control system. Thus, the driving motion imparted to the slide can be adjusted to obtain efficient production of a variety of deepdrawn stampings. When the drawing stroke is completed, the high-speed driving unit is automatically engaged to return the slide quickly to the original starting position.

This drive has the advantage of moving the slide at a slow speed during the drawing portion of the stroke so that the metal is forced into the die without wrinkling or tearing. An additional advantage is the extra rapid advance and return movements which are imparted to the slide.

Circle Item 115 on postcard, page 257

Fig. 2. Cut-away view showing design of clutch with automatically controlled two-speed driving system used on machine shown in Fig. 1

Landis Automatic Piston-Grinding Machine

A precision grinding machine which automatically loads, grinds and discharges automotive pistons on a conveyor at a high production rate has been developed by the Landis Tool Co., Waynesboro, Pa. Aluminum pistons delivered to the machine by a conveyor and transfer mechanism are placed in position for grinding by an automatic timed loader. Rotation of the piston begins as the abrasive wheel advances rapidly to the grinding position. A slow grinding feed is then automatically engaged to finish the piston to a predetermined size. After a timed sparkout period, the grinding wheel retracts rapidly to its starting position and the piston is ejected onto a conveyor. Another piston is then loaded and the cycle repeated.

The aluminum pistons are ground by the infeed method, using a wide wheel which reciprocates laterally during the grinding cycle. The elliptical shape of the piston is produced by using a master cam and a rocking work-cradle.

Wheel dressing is performed automatically after a predetermined number of pistons have been ground. The wheel-head is automatically advanced to compensate for any change in the size of the wheel resulting from the dressing operation. This eliminates hand adjustments and returns the wheel-head to the correct position, thus holding the work to size.

The 5-inch Type H piston grinder has Microsphere bearings for both the work-head spindle and the wheel-spindle. These bearings are of one-piece steel construction, with babbitt linings and faces. The spherical shape permits accurate alignment of the spindle and close adjustment of the running clearance. The Microsphere bearings are automatically lubricated by a system in which pressure must be built up before the motors can be started. If there is pressure failure, rotation of the grinding wheel and the workspindle will stop. The 5-inch by 8-inch Type H machine, Fig. 1, removes 0.015 inch of stock and has an estimated production rate of 115 pistons per hour.

Circle Item 116 on postcard, page 257

Fig. 2. Close-up of work loader and ejector of the 5-inch by 8-inch Type H Landis machine illustrated in Fig. 1

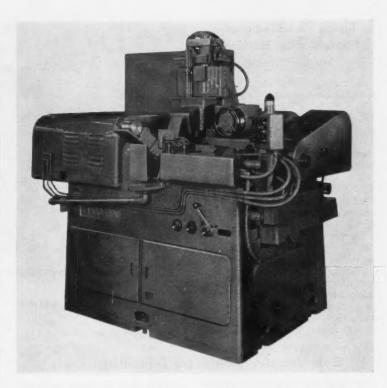


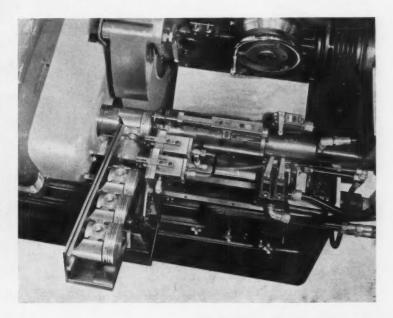
Fig. 1. Automatic piston-grinding machine developed by the Landis Tool Co.

Diamond Micro-Finishing Compound

A diamond compound for microfinishing and precision lapping has been added to the diamond products of Anton Smit & Co., Inc., New York City. This product is available in eight different grade numbers covering a micron

size range of 0-2, for use in obtaining the finest finishes for metallographic specimens and optical work, to a micron size range of 30-60 adapted for preparatory finishing of carbides, hardened steels, and sapphires. A No. 60 diamond compound is available for fast stock removal.

Circle Item 117 on postcard, page 257



Littell Variable-Speed Straightening Machine for Coil Stock

A variable-speed straightening machine has been designed by the F. J. Littell Machine Co., Chicago, Ill., for the handling of ferrous and non-ferrous stock. Thin coil stock passed through the seventeen power-driven straightening rolls of this machine has the curvature removed and is ready for automatic feeding to the press. The variable drive permits easy adjustment of the straightening speed to the speed of the press.

This machine, designated the "208," is also said to be effective in removing from flat parts the curvatures induced by stamping operations. Parts up to 3/32 inch thick are straightened as they pass through the power-driven rolls. Contact springs, condenser plates, radio, television and cal-



Littell variable-speed straightening machine for thin coil stock

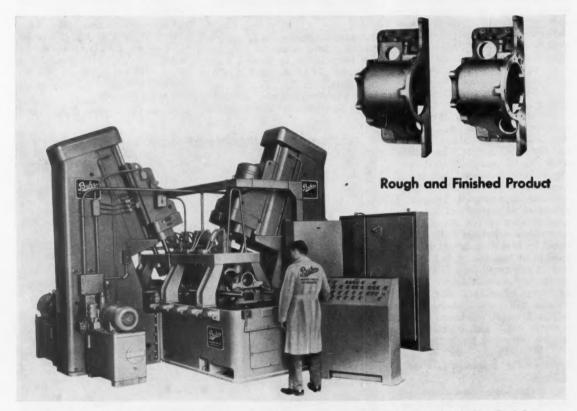
culating machine parts are typical work handled.

Circle Item 118 on postcard, page 257

Buhr Transfer Machine for Transmission Cases

A six-station transfer machine built by the Buhr Machine Tool Co., Ann Arbor, Mich., performs a series of operations on automatic transmission cases that previously required the use of several singlespindle machines. The model features automatic shuttling of parts between stations and automatic clamping of parts at each of the working positions. The stations are equipped for drilling, chamfering, and individual lead-screw tapping of automatic transmission cases at the rate of 105 an hour.

Precision alignment of the ma-



Transfer machine for drilling and tapping automatic transmission cases built by the Buhr Machine Tool Co.

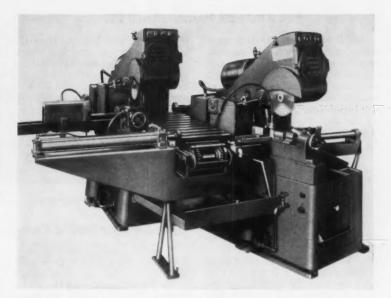
chine is insured by complete interchangeability of parts and by the location of all component assemblies by dowels fitted in precisionbored holes. Other features include: automatic chip disposal unit, tapping spindles of the leadscrew type with precision-ground and hard chrome-plated threads; hardened and ground laminated tool-steel ways which are automatically lubricated; multiple heads of Buhr ball-bearing construction with shaved gears and broached and splined drives; and hydraulic and electrical equipment designed to J.I.C. standards.

Circle Item 119 on postcard, page 257

Tensile Testing Machine for Radioactive Materials

A tensile testing machine for radioactive materials has been built by the Tinius Olsen Testing Machine Co., Willow Grove, Pa. This machine has horizontally mounted loading, weighing, and gripping mechanisms which are separate and remote from the dial indicator and the two stress-strain recorders. A single wire connects the testing and indicating units.

The equipment has a capacity of 15,000 pounds and accurately indicates the load applied to the specimen on the Selectorange dial indicator. One recorder makes a permanent record of the extension between the gage points on the



Special stock cutting machine built by Motch & Merryweather Machinery Co.

specimen while under load, while the other recorder shows the overall extension of the specimen. This permits a comparison of the results of every phase of the test.

Circle Item 120 on postcard, page 257

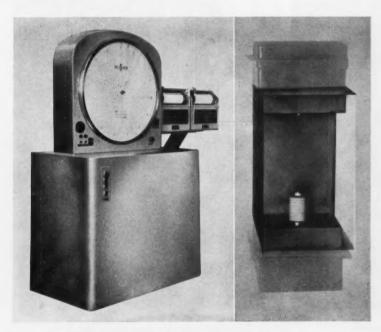
Motch & Merryweather Cutting-Off Machine

Two Model OOG automatic circular sawing machines made by the Motch & Merryweather Machinery Co., Cleveland, Ohio, have been combined, as shown in the illustration, to handle a special stock cutting-off job. This equipment will cut from bar stock pieces 2 5/8 inches in length, with a right-angle (90-degree) cut on one end and a 15-degree angular cut on the opposite end at a high production rate.

The machine shown at the rear in the illustration cuts off a piece of bar stock twice the finished length to provide the square ends on two pieces. A chain-operated conveyor then indexes the cut piece to the second loading station on the machine shown nearest the front in the illustration. This machine is positioned at a 15-degree angle and is equipped with angular jaws on a double-acting, self-equalizing vise, which holds the doublelength piece while it is being cut into two pieces by a circular saw blade. By cutting the bar in half in this manner, two pieces are obtained, each with the desired 15degree angle at one end and a 90-degree angle at the opposite

Stock is fed automatically to a stock stop on each machine. Each stop actuates its respective vise when the stock is pushed against it. The stock stop thus gages the lengths to be cut. The sawing cycle begins as soon as the vise has clamped the stock. As many as 89 cuts per hour are possible on c-1118 hot-rolled steel bars 1 1/2 by 2 5/8 inches.

Circle Item 121 on postcard, page 257



Olsen tensile testing machine for radioactive materials

Sun All-Angle Portable Drill Press

An all-angle portable drill press designed to permit drilling and tapping with its spindle located in almost any position, and which combines all the advantages of conventional fixed radial and portable type machines, is announced by the Sun Tool & Machine Co., Toledo, Ohio. The press is said to make substantial savings in time possible because it permits bringing the machine to the job and in many cases eliminates the necessity for disassembling large and heavy work-pieces for drilling operations.

Holes can be drilled or tapped as close as 14 1/2 inches to the machine column and as far from it as 38 inches. The machine head can be rotated a full 360 degrees from the vertical position and the drill head can be rotated 360 degrees on the column. Four spindle speeds—185, 280, 400, and 600 R.P.M.—are available. Holes up to a diameter of 1 1/4 inches can be drilled to a depth of 5 inches, and 5/8-inch United States Standard threads can be tapped in cast iron.

Maximum distance from the spindle to the base is 59 inches, but the machine may be ordered in any column height. Over-all height of the standard drill press is 86 inches and the over-all dimensions of the base are 6 by 28 by 43 inches. It requires a floor space of 28 by 60 inches and will go through an opening 30 inches wide and 90 inches high. Total weight of the press is 2500 pounds. The base is equipped with four roller-bearing wheels so that a 50-pound pull will easily move it from a standstill on a concrete floor.

Circle Item 122 on postcard, page 257

Open-Back Inclinable Press

A 45-ton press with a heavy-duty frame and built-in high tensile steel tie-rods has been added to the Press-Rite line of the Sales Service Machine Tool Co., St. Paul, Minn. This open-back press has been especially designed to reduce deflection and increase the life of the dies. It is available with a single-stroke safety mechanism, cam-actuated automatic brake, and four-point mechanical clutch, or it can be equipped with an "Airflex Air Friction" drum type clutch, and a brake with electric controls.

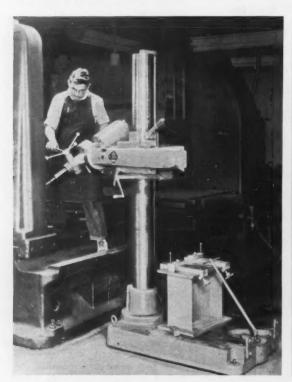
The standard stroke is 3 inches and the maximum stroke, 6 inches, with a slide adjustment of 2 inches. The crankshaft has a diameter of 4 inches at the main bearings. The bolster surface is 20 by 30 inches.

With the mechanical clutch, the standard speed is ninety strokes per minute. When equipped with an air friction clutch, higher speeds are possible. The press occupies a floor space only 50 by 45 inches, has an over-all height of only 69 1/2 inches from the fioor to the center of crankshaft, and is regularly equipped with a 5-H.P. driving motor.

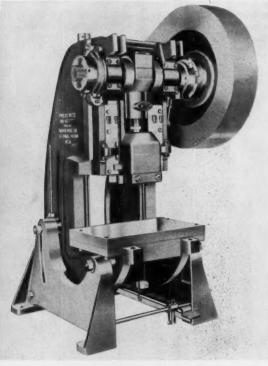
Circle Item 123 on postcard, page 257

Brown High-Speed Pin-Cutting Machine

The L. R. Brown Mfg. Co., New Haven, Conn., has brought out a high-speed pin machine designed to cut wire from 1/8 to 3/16 inch in diameter into pins having lengths of from 7/16 inch to 43/4 inches, at the rate of from 18,000 to 75,000 per hour. The pins are held to length within plus or minus 0.0025 inch, and are said to have perfectly cut ends and to re-



All-angle portable drill press brought out by the Sun Tool & Machine Co.



Open-back inclinable press announced by the Sales Service Machine Tool Co.



High-speed pin-cutting machine brought out by L. R. Brown Mfg. Co.

quire no tumbling for the removal of burrs.

The machine is driven by a 3-H.P. electric motor. An arbor straightens the stock as it enters the machine, and an adjustable micrometer stop controls the length of the cut-off pins. The setup can be changed from one size wire pin to another in ten minutes.

Circle Item 124 on postcard, page 257

Covel Hydraulic Feed Surface Grinders

Two improved hydraulic feed surface grinders designed to produce a wide variety of precision work rapidly and economically are being introduced by the Covel Mfg. Co., Benton Harbor, Mich. The Model No. 20 will grind work 6 by 18 by 12 inches under a grinding wheel 10 inches in diameter with a 3/4-inch face and a 3-inch spindle hole. The No. 35 will handle work 8 by 24 by 11 inches under a wheel 12 inches in diameter.

Infinitely-variable table speeds of 10 to 90 feet per minute are available on these grinders. Three-speed quill type spindles that are lubricated and sealed for life and equipped with precision ball bearings are standard equipment. Improvements include a closed hy-

draulic circuit with pump and motor mounted on the top of a removable tank; vertical slide ways 4 inches wider than on previous models, and saddle and base column ways that are 6 inches wider.

Circle Item 125 on postcard, page 257

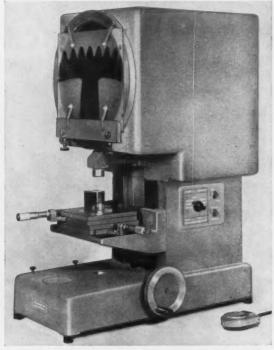
Stocker & Yale Optical Projector

Stocker & Yale, Inc., Marblehead, Mass., has introduced a Model 10 optical projector which is especially adapted for use in the control of precision assemblies and components. It features the newly developed Syntar lens systems designed to produce clear, sharp images having exact magnification over the entire surface of the projection screen. Magnification of from 10 to 100 times the size of the object inspected may be obtained by vertical or horizontal projection systems. Either contour projection or front surface projection, or both are possible by the flick of a switch. Intricate parts can be checked by master screens or measured directly by accessory micrometer measuring stages.

Lenses which are interchangeable among all instruments pro-



Covel improved hydraulic feed surface grinder



Optical projector introduced by Stocker & Yale, Inc.

vide convenience and economy in multiple installations. A footswitch control extends lamp life and provides for dimming during loading operations. The projector weighs 70 pounds and has a base 9 by 20 inches.

Circle Item 126 on postcard, page 257

Walsh Punch Presses with Hi-Flex System

Open-back, inclinable punch presses in capacities ranging from 6 to 65 tons, manufactured by the Walsh Press & Die Co., Chicago, Ill., have been given greater production flexibility through the addition of the packaged Hi-Flex system which includes a variablespeed drive, high-speed, mechanical on-off brake, and an automatic lubricating system. These presses can be operated at a wide range of speeds. For example, a 24-ton press equipped with the package system has a range of from 70 to 210 strokes per minute and a 12ton press has a range of 160 to 480 strokes per minute. Speed changes can be made while the press is in operation, enabling fine adjustment.

Safety for both dies and operator are part of the Hi-Flex system. The brake will stop the press at the completion of a cycle, even when it is operating at maximum speed. Low maintenance is provided by the automatic lubricating system, which can be applied to Walsh presses already installed.

Circle Item 127 on postcard, page 257

Milling Head for Planers

A motor-driven spindle head for adapting planers and milling machines to high-speed milling for use with indexable carbide cutters has been announced by the Detroit Milling Cutter Co., Farmington, Mich. The spindle is driven by a 20-H.P., fan-cooled motor with glass-wound insulation. The rotor is connected directly to the milling spindle and operates at a speed of 1200 R.P.M.

Four table feeds, ranging from 30 to 120 inches per minute, are available. A "Loadmeter" furnished as standard equipment shuts off the feed motors if the spindle is seriously overloaded. A constant feed device available as auxiliary equipment permits the spindle to be operated continuously at maximum capacity without the risk of cutter breakage. When the machine is set for the amperage load desired, the table speed will be varied automatically within the

range of 30 and 120 inches per minute to maintain the preselected load.

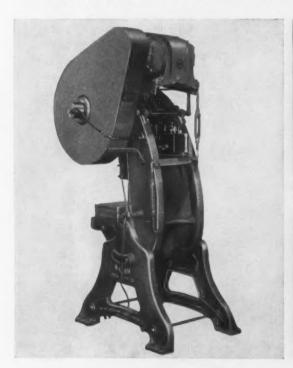
The illustration shows a "Futurmill" cutter having eight octagonal solid carbide blades being used to machine a 23- by 23-inch mild steel block to a depth of 1/8 inch. Seven cuts are taken at a feeding rate of 60 inches per minute.

The cutter blades can be quickly indexed when dull to set up new cutting edges. When all edges are dull, the blades can be sent back to the factory for regrinding.

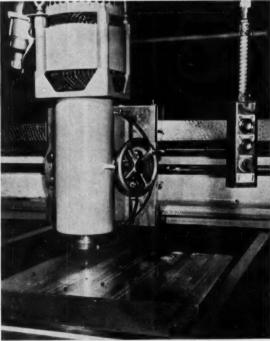
Circle Item 128 on postcard, page 257

Falk Spacer Type Coupling

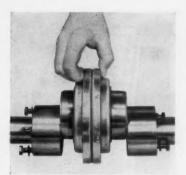
A Steelflex spacer type coupling has been brought out by the Falk Corporation, Milwaukee, Wis., for use between motors and pumps when a gap between shafts must be provided to permit removal of pump impeller shaft assemblies. This coupling can also be used for any application where a large gap (up to 12 inches) between shafts cannot be avoided. In addition to the protection that the coupling provides against damage from impact loads and shaft misalignment, it affords an easy means for con-



Walsh Hi-Flex 24-ton press with variable-speed drive, on-and-off brake and automatic lubricating system



Motorized milling head for planers and milling machines brought out by the Detroit Milling Cutter Co.



Steelflex spacer type coupling made by the Falk Corporation

necting and disconnecting shafts without disassembling the unit. The coupling is prelubricated at the factory and requires the addition of lubricant by means of a grease gun only once every six months.

Circle Item 129 on postcard, page 257

Beko Balancing Machines

A series of nine Beko heavyduty, general purpose, static and dynamic balancing machines for small and medium-size rotors is announced by the Balance Engineering Co., Chicago, Ill. These machines are especially adapted for balancing motor armatures and rotors, impellers, blower wheels, flywheels, fans and pulleys.

Magnitudes of unbalance are indicated by a large, easy-to-read meter directly in terms of the correction procedure selected. Angular positions are pointed out on top of the rotor by a stroboscopic lamp, and are readable either as the location for removal or addition of weight.

Circle Item 130 on postcard, page 257

Coverings for Metal Parts Developed to Prevent Corrosion

Coverings designed to prevent rusting of metal parts, known as V-Lopes, developed for the Armed Forces and approved under United States Army Specification P3420, are being placed on the market by the Westwill Co., Westport, Conn.

The V-Lope consists essentially of a sturdy Kraft sheeting container impregnated with a chemical compound. Precision tools, guns, or any iron or steel implement enclosed by the protective covering is immediately subjected to a dry vapor which rustproofs every portion of the metal. The

covering material is available in 25-foot rolls, as well as in envelopes 9 by 12 inches.

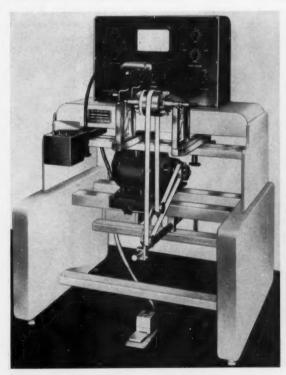
Circle Item 131 on postcard, page 257

Industrial Scrubbing Machine for Cleaning Metal Sheets

An industrial scrubbing machine that cleans both sides of metal sheets from all traces of surface dirt and oils has been developed by the Fuller Brush Co., Machine Division, Hartford, Conn. This machine cleans plates to the high degree necessary to pass successfully the water-break test for cleanliness. That is, the film of water spread on the surface will be continuous when the plate is clean, but the film breaks where any surface oil remains.

Both short and long models are available. The longer machine is designed to remove heavier accumulations of surface dirt. Either machine will process sheets at the rate of 60 feet a minute. A detergent and water solution is pumped on the plates when they enter the machine. They are scrubbed with nylon cylindrical brushes, and rinsed and dried as they come out.

Circle Item 132 on postcard, page 257



Rotor balancing machine of Beko line announced by the Balance Engineering Co.



Short model of metal sheet scrubbing machine brought out by the Fuller Brush Co.

Cincinnati All-Geared Head Tray-Top Tool-Room Lathes

Two Tray-Top machines, built to the exacting standards of accuracy set forth for tool-room lathes by the National Machine Tool Builders' Association, are announced by the Cincinnati Lathe and Tool Co., Cincinnati, Ohio. These all-geared head lathes have swing capacities of 21 1/2 and 26 inches. Each lathe has twelve spindle speeds arranged in geometric progression. The speeds are controlled by a three-lever, colormatch, direct-reading gear-shifting mechanism. The standard spindle speed range is from 16 to 640 R.P.M. and the high-speed range is from 24 to 960 R.P.M. The spindle has a long tapered key-drive nose and is rigidly mounted in three precision antifriction bearings. The diameter of the regular size hole through the spindle is 113/16 inches for the 21 1/2-inch lathes, but a 2 7/16inch diameter hole is available on special order. The 2 7/16-inch diameter spindle hole is standard for the 26-inch lathes. All headstock bearings, gears and shafts are pressure lubricated.

Fifty-four thread and feed changes are made available through a totally enclosed, automatically lubricated quick-change gear-box which has a lever for reversing the lead-screw. The threadcutting range is from 11/2 to 92 threads per inch. Carriage feeds range from 0.0019 to 0.1215 inch per revolution of the spindle, and cross-slide feeds from 0.0009 to 0.0578 inch.

The apron is a one-piece, double-walled casting equipped with automatic lubrication. Longitudinal-and cross-feeds are engaged with drop-levers which operate positive jaw clutches. A spindle start-stop control lever is supplied at the apron and quick-change gear-box.

The bedways are ground, and can be flame-hardened on special order. Lubrication of the carriage ways and the cross-slide is provided by an oil shot plunger on the apron. A fully enclosed electrical panel provides a safe and accessible place for the power connections. A built-in disconnect switch guards against exposing a livewire panel. Power is transformed from 220 volts and over to provide only 110 volts at the push button.

These lathes are offered with a 5 or 71/2 H.P. motor mounted on the rear of the headstock for easy maintenance. Tray-Tops on the headstock and tailstock provide safe places for micrometers, tools, drawings, or gages.

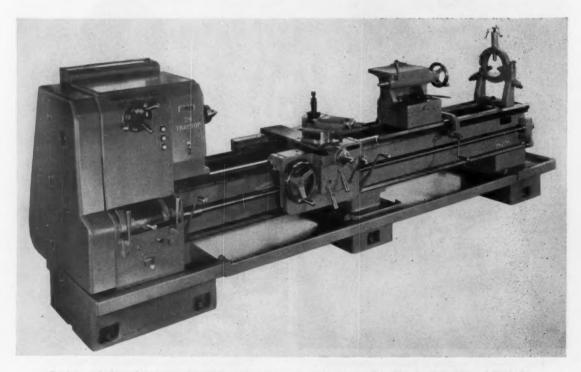
Circle Item 133 on postcard, page 257



Sperry Reflectoscope for automatic non-destructive testing of materials and parts

Sperry Reflectoscope for Testing Materials and Parts

Production models of highly sensitive ultrasonic instruments for non-destructive testing of materials, machines, and components have been announced by Sperry



Tool-room lathes of the geared-head Tray-Top design brought out by the Cincinnati Lathe and Tool Co.

Products, Inc., Danbury, Conn. This equipment transforms electrical impulses into sound waves which are transmitted through material or machine parts. Reflections, or echoes, of the sound waves from any structural discontinuity are transformed into visual indications on a screen. These indications show both the nature and location of the defects. The locating accuracy is estimated to be within 2 per cent.

The Sperry UW Reflectoscope, illustrated, has nine frequency ranges, and gives both aural and visual signals. It is designed for either contact or immersed ultrasonic inspection and has a pulse rate that is variable from 60 to 1000 impulses per second. The higher repetition rate provides greater brilliance and faster automatic scanning speeds. This unit is said to be capable of testing through as much as 125 feet of material and of finding tiny invisible defects as close to the surface as 0.05 inch.

The instrument is ruggedly built for quality control, maintenance and safety inspection operations in plants manufacturing aircraft and other complex fabricated products, as well as for use in steel mills, forge shops, and foundries. It is equipped for one or two search unit operations with cables facilitating use at distances up to 50 feet.

When employed for automatic

production-line testing of materials, machinery, or parts, defects are indicated either by visual presentation on cathode ray tube, the signal lamp on the control panel of the Reflectoscope console.

or elsewhere by light, bell, or buzzer. Connectors are provided for pen recorders and for devices to automatically stop the machine should defects be encountered.

Circle Item 134 on postcard, page 257

La Salle Automatic Machine for Piston Production Line

Automation has been applied effectively in the design of an automotive piston-processing machine developed by La Salle Tool, Inc., Detroit, Mich. During the processing operations one piston never touches another and is never slid or rolled from one station to the next. Suspension fingers made of nylon and attached to shuttle tracks, lock the piston in position for each operation, including transferring the work from station to station. These nylon fingers not only prevent marking or marring of the pistons, but always hold them rigidly without permitting any swinging motion.

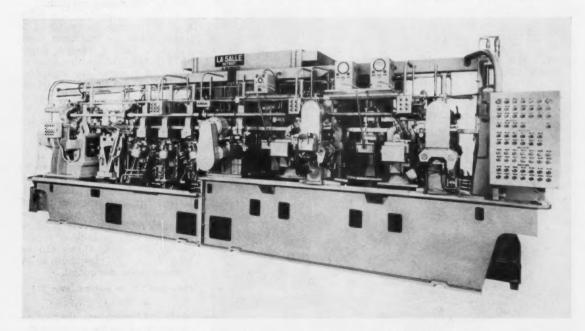
At the loading station, a location bar aligns the pistons in their proper positions. If a piston is fed in backwards, the machine corrects the situation without stopping. A simple mechanism activates the shuttle tracks to move the pistons from station to station.

The accompanying illustration shows the sixteen-station portion of the piston-line machine which performs the following operations after the work is loaded at the first

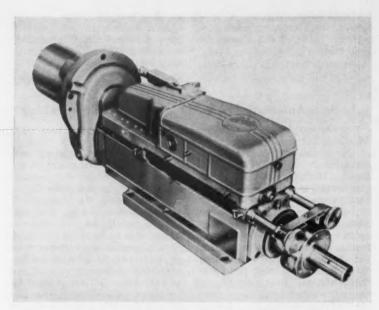
station: rough-bores and chamfers wrist-pin hole on both sides of piston; and checks wrist-pin hole at each end with air gages. If the piston is either over size or under size, this condition is indicated by the gage, and the machine is stopped automatically. The machine is arranged with an idle station at this stage of the operating cycle to provide access to the work or equipment. At the next station, snap-ring grooves are machined on both sides and are checked by air gages. Succeeding another idle station, there is a sawing station where two slots are cut in the oilring groove. The valve clearance in the head of the piston is milled, the center boss is removed from the head of the piston, and valve clearance is milled in the head of the piston in successive operations.

A ten-station machine, similar in design to the one shown, completes the piston processing. Production is at the rate of 400 pistons per hour. Accuracy on the balancing machine is held within plus or minus 1 gram.

Circle Item 135 on postcard, page 257



Sixteen-station unit of automatic piston-processing machine developed by La Salle Tool, Inc.



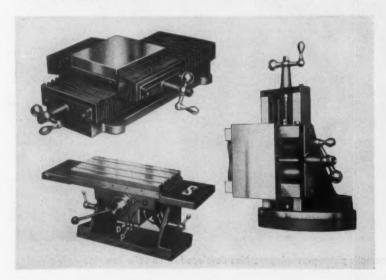
Air-O-Matic drill unit announced by the Morris Machine Tool Co.

Morris Air-O-Matic Drill Units

An automatic, self-contained drill unit designed for a wide range of applications has been announced by the Morris Machine Tool Co., Cincinnati, Ohio. This unit is available in two models. Although most parts of the two units or models are interchangeable, one is powered by oil and the other by compressed air. Both are hydraulically controlled and designed for drilling, tapping, reaming, chamfering, hollow-milling, centering and related operations. The units can be mounted vertically, horizontally, or at an angle. Feed in both directions can be attained by turning a set screw.

These drill units have adjustable feed, feed-stroke, and quick approach rate. Controls and actuating devices can be set to provide virtually any combination and sequence of operations. The maximum stroke is 6 inches with the feed-stroke infinitely variable between 0 and 4 1/2 inches. The rapid approach movement is variable from 0 to 6 inches. Instantaneous return or delay between feed-stroke and rapid return, multiple feeds and rapid approaches easily obtained with special feed dogs are other features of the

Three methods of driving the



spindle provide a wide range of speeds. Either a gear, or pulley drive, or a combination of the two. is used to obtain spindle speeds ranging from 266 to 5000 R.P.M. In all cases, the spindle drive is separate from the feed; either may be varied independently of the other. A typical unit is 331/4 inches long, 11 inches wide and 23 inches high and has a capacity for drilling holes up to 5/8 inch in diameter. The feed rate ranges from 0 to 48 inches per minute: quick approach from 174 to 300 inches per minute; and quick return from 174 to 488 inches per minute.

Circle Item 136 on postcard, page 257

Slide, Feed, and Table Attachments for Machine Tools

The Standard Electric Tool Co., Cincinnati, Ohio, has completely redesigned its line of slides, feeds, and tables for machine tools. These attachments are compact in design and are constructed to accommodate loads ranging from 5 to 2500 pounds. They are available in single or compound traverse units. Each traverse movement is obtained by operating a crank attached to a 10-pitch feed-screw. One revolution of the crank produces a travel movement of 0.001 inch. The assembly base and the mounting pad, or both, are available for 360-degree rotation.

The smallest dovetail slide units have a traverse movement of 5 inches, while the maximum stock size units have a traverse range of 12 inches. Slides with a greater length of traverse are available. These units can be had in various styles and combinations arranged for either single or compound traverse, and for flat, vertical, or inverted mounting. Anti-friction traverse types can also be supplied.

The precision table with antifriction bearings, dovetail slide, and taper gibs shown in the lower left of the illustration is 8 by 21 inches. The ways and bearings of this table are fully protected for use with face or surface grinders equipped with a coolant supply system. The table shown can be tilted from 3 degrees above to 30 degrees below horizontal.

Circle Item 137 on postcard, page 257

Redesigned attachments for machine tools, placed on the market by the Standard Electric Tool Co.

Hardinge Chucking Machine and Tool-Room Lathe

The Model HCT high-speed precision chucking machine, Fig. 1, developed by Hardinge Brothers, Inc., Elmira, N. Y., will be shown for the first time at the Western Industrial Exhibition of the American Society of Tool Engineers at Los Angeles, Calif., March 14 to 18. The latest models of the HLV high-speed precision tool-room lathe, Fig. 2, will also be demonstrated at this exhibition with other recently developed precision metal-working machines.

Infinitely variable-spindle speeds from 130 to 3000 R.P.M. are instantly available through the three-selector variable-speed drive of the precision chucking machine, Fig. 1. Any combination of three speeds can be pre-set by means of adjustable master cams connected to the actuating unit. After selecting the speeds, it is only necessary to move the control lever to change instantly to the pre-set spindle speed corresponding to the lever position.

The infinitely variable threeselector drive, coupled with the infinitely variable power feed for the carriage, makes it easy to obtain the desired surface finish and production rate. Changes in the power feed rate can be instantly obtained by simply turning the electric control knob.

The eight-station cross-feeding turret provides for a wide range of tool set-ups and is designed for work requiring extreme accuracy. Round stock up to 1 1/16 inches in diameter can be held in the 5C Hardinge collet which is seated directly in the spindle to obtain maximum accuracy. Through the use of step chucks and closers, work up to 6 inches in diameter can be readily chucked. A production threading head is available which permits rapid machining of accurate threads.

The HLV high-speed precision tool-room lathe, Fig. 2, also has an infinitely variable-speed drive for the spindle. With this drive the spindle speed can be increased or decreased by simply touching a control button. Selection of the exact speed desired, up to 3000 R.P.M., can be done while the tool is cutting.

Fig. 2. Hardinge Model HLV highspeed precision tool-room lathe with improved drive

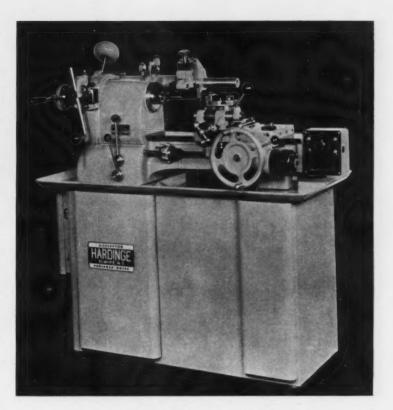
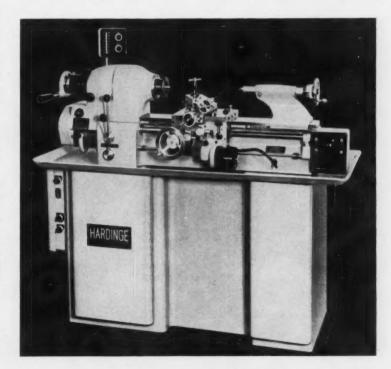


Fig. 1. Hardinge Model HCT high-speed precision chucking machine

An independent electric variable-feed for the carriage and crossslide permits changing the feeding rate instantly at any time, even while the tool is cutting, and without changing the spindle speed. With this arrangement, it is a simple matter to obtain the



exact feed for efficient chip removal and best surface finish by simply turning the control knob.

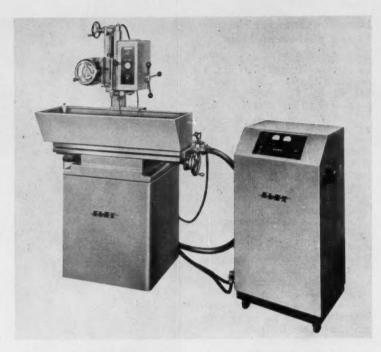
The gear-box for precision threading operates only when thread-cutting. Standard threads, including pipe threads, can be cut. By the use of outside changegears, threads with pitches as fine as 250 threads per inch can be cut.

This 10-inch toolmaker's lathe has a swing of 11 inches over the bed, 9 inches over the carriage, and 5 3/4 inches over the cross-slide. Maximum distance between centers is 20 inches. The machine is 63 inches long, 30 inches wide, 58 inches high, and weighs 1250 pounds.

Circle Item 138 on postcard, page 257

Elox Improved Electron Drill

An improved M-500 Electron drill developed by the Elox Corporation of Michigan, Clawson, Mich., will be on exhibit for the first time at the American Society of Tool Engineer's Show in Los Angeles, Calif. The operation of this precision electronic machine tool in the machining of various



Improved Electron drill brought out by the Elox Corporation of Michigan

intricate shapes and dies in cemented carbide materials will be demonstrated at the show.

Circle Item 139 on postcard, page 257

are products of the Sheffield Corporation, Dayton, Ohio.

Sheffield Plunjet gaging cartridges serve as the size-sensing elements of the gage shown in Fig. 1. In using this gage, the operator simply places the part on the serrated work-table and slides it forward into the gaging position. The five dimensions are instantly checked and the floats in the five air columns indicate which

Sheffield Precisionaire Gages

Three outside diameters and two flange thicknesses of a cylinder are inspected simultaneously on the Precisionaire gage shown in Fig. 1. This gage, and the Precisionaire gage for inspecting the 0.078-inch inside width of a television tube component, illustrated in Fig. 2,

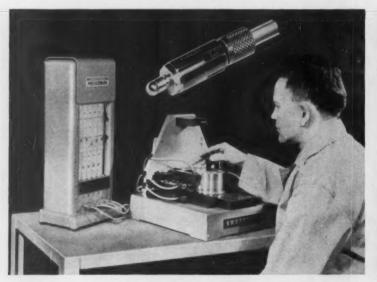
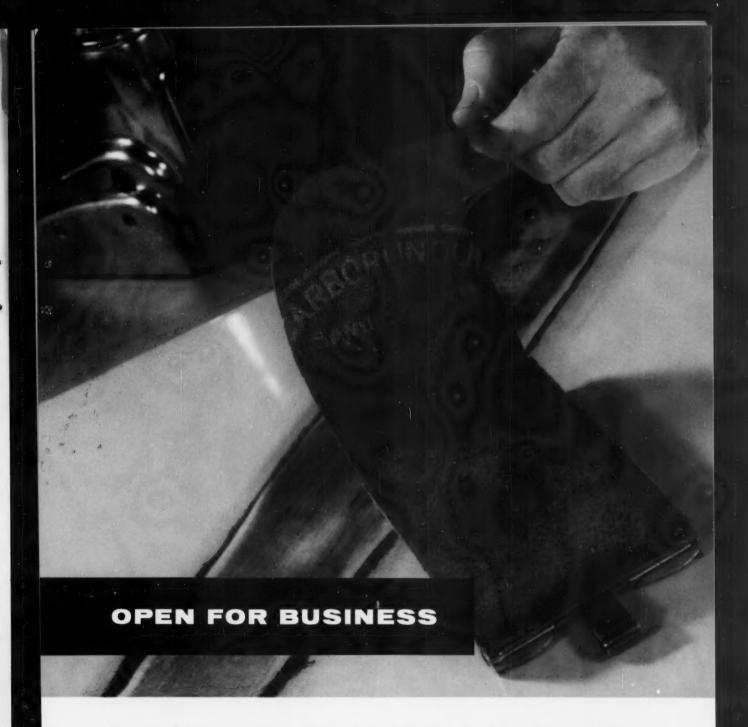




Fig. 1. (Left) Sheffield Precisionaire gage checks five dimensions of cylinder simultaneously.

Fig. 2. (Right) Precisionaire gage for inspecting inside width of television part



"SAND SCREEN'S" unique open-mesh construction lets removed material flow right through ... instead of loading or glazing, like conventional paper and cloth. What's more, both sides are usable-give you 7 to 15 times longer life. Use "SAND SCREEN" wet or dry, by hand or machine. It tears and folds easily to any desired size. Cut sheets fit oscillating or vibrating machines. "SAND SCREEN" Discs give best results when used wet with CARBORUNDUM'S FASTCUT® Pad 85 Assembly. Try it-see how it

slashes polishing and finishing costs in your shop. For a free sample, call your CARBORUNDUM Distributor or salesman, or write The Carborundum Company, Niagara Falls, N.Y. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ont.

Through product quality and application "know-how"

continually puts more sense in your abrasive dollar



PHOTOGRAPHED AT MORRISON STEEL PRODUCTS, INC.

One look at this new Resin Sander Disc by CARBORUNDUM tells you it's no sissy. One trial in your shop proves how tough it is. It bites into metal fast...cuts free and cool...stays sharp from start to finish. The rugged allfibre backing, plus a resin bond with greater holding power, means far more work per disc. The edge holds shape longer, even on your most severe grinding jobs. Resin Sander Discs are designed for both snagging and surfacing operations, come in types and sizes to fit all Disc Sanders.

For a free demonstration of this new cost-cutter, call your CARBORUNDUM Distributor or salesman today. Or write The Carborundum Company, Niagara Falls, New York. In Canada: Canadian Carborundum Company, Ltd., Niagara Falls, Ontario.

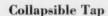
Through application "know-how" and product quality

continually puts more sense in your abrasive dollar

dimensions are within the specified tolerance, or the amount they are over or under size. The Plunjets are available for inspecting parts with tolerances ranging from 0.0001 to 0.100 inch.

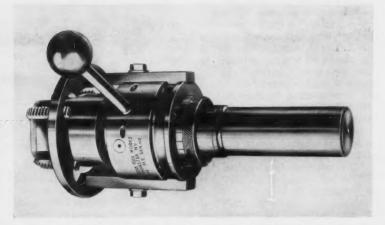
The small television tube part inspected by the gage shown in Fig. 2 is simply slipped over a chromium-plated spindle incorporating a single air jet and held in position by a small hold-down wheel. The position of the float in the air column indicates instantly whether the width being gaged is within the specified tolerance or the amount it is over or under size.

Circle Item 140 on postcard, page 257



Modern Tool Works, Consolidated Machine Tool Co., Rochester, N. Y., has announced a collapsible tap, type MC, which is made in five sizes covering a range from 1 15/16 to 3 1/2 inches. These taps have micrometer adjustments in increments of 0.001 inch that permits quick, accurate adjustment of the thread size.

Approximately three-quarters of the component parts of the five different sizes of taps are identical and interchangeable. Thus, one complete tap and four sets of body parts cover the same size range as five complete taps. The shanks are



Collapsible tap made in five sizes by the Modern Tool Works

detachable from the tap body and can be furnished to fit any machine socket. A floating action between the shank and the body compensates for any misalignment. Circle Item 141 on postcord, page 257

Combined Hardness Tester and Measuring Microscope, and Optical Micro-Projector

Two precision instruments—a Leitz hardness tester and measuring microscope, Fig. 1, and a Wilder micro-projector, Fig. 2—have been announced by George Scherr Optical Tools, Inc., New York City.

The instrument shown in Fig. 1 has been designed for use in inspection departments, tool and die shops, laboratories, and metalworking plants in general. It

can be used as a micro-hardness tester and also as a measuring microscope where the amount of testing does not warrant the purchase of two separate instruments. This instrument is especially adapted for precise hardness testing of small or thin parts; fine wires; cutting edges of tools; as well as the surface layers of case-hardened work.



Fig. 1. Hardness tester and measuring microscope announced by George Scherr Optical Tools, Inc.



Fig. 2. Wilder micro-projector optical comparator introduced by George Scherr Optical Tools, Inc.

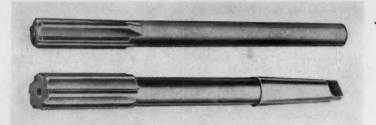
Indentation, invisible to the naked eye, is achieved by means of a Vickers' diamond and then made visible by a magnification of 400X. The indentation is measured by means of a graduated ocular unit with 0.005 millimeter graduations. When the instrument is used as a measuring microscope, the 100X magnification lens is employed. The micrometer drums have 0.0001-inch graduations and a total measuring range of 2 by 11/2 inches.

The micrometer stage of the Wilder micro-projector, Fig. 2, has a longitudinal movement of 2 inches and a cross-movement of 1/2 inches. The micrometer drums have 0.001 inch graduations. The micrometer takes care of 1-inch measurements in either direction, and gage blocks are employed for larger dimensions. A vertical light beam is used for the flat work stage, permitting most parts to be placed on the stage without requiring holding fixtures. Seven different magnifications are available, ranging from 10X to 100X. A surface illuminator provides for inspecting stamps, coins, and small precision parts.

Circle Item 142 on postcard, page 257

Semi-Finished Reamers

A line of semi-finished carbide reamers is being offered by the Super Tool Co., Detroit, Mich. The chief advantage claimed is the reduced inventory that is required. A limited stock can be kept on



Semi-finished carbide reamers announced by Super Tool Co.

hand and finish-ground to size as needed. In addition, the semi-finished reamers have a lower initial cost. They are furnished in regular and flute-long types, with straight or tapered shanks, and with 0.020 inch of grinding stock.

Multi-Max 250-Ton Press

The Diamond Machine Tool Co., Pico, Calif., has announced the addition of a 250-ton machine to its line of Multi-Max punch presses. This giant size press is equipped with an air disc clutch and air brake. The adjustable column bearings are air counterbalanced and the twin drive has two bull gears, each 42 inches in diameter with a face width of 6 inches. Each gear has an integral cam in place of a crankshaft.

Arrangements can be made for draw-die twin cushions. Electrical controls are of the single cycle or continuous running type and provision is made for operating the press drive in either direction.

The ram size between columns is 4 feet by 8 feet. The minimum stroke is 6 inches and the maximum stroke is 12 inches. Ram adjustment by power is 4 inches. Shunt die height ranges from 20 up to a maximum of 48 inches. Speeds range from 20 to 35 R.P.M. The press is driven by a 40-H.P. motor.

Circle Item 144 on postcard, page 257

Giant Size Rotary Magnetic Chuck

A rotary permanent-magnet chuck believed to be the largest of this type ever made was completed recently by the O. S. Walker Co., Inc., Worcester, Mass. This chuck is 48 inches in diameter and will be used for work where any danger of generating electric sparks must be eliminated.

Circle Item 145 on postcard, page 257



Giant size press built by Diamond Machine Tool Co.



Huge rotary magnet chuck built by O. S. Walker Co., Inc.

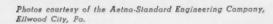
top performers

AETNA-STANDARD ENGINEERING CO.

The Aetna - Standard Engineering Company say-"It is our opinion on radial drills that Cincinnati Bickford Super Service Radial Drills are top performers from the standpoint of service and handling ease".

Illustrations show the top carriage of gun carriage being drilled, tapped and reamed complete on this Cincinnati Bickford Super Service Radial—holes from $\frac{1}{4}$ " to $1\frac{1}{4}$ ", limits within .0005".

Write for Booklet R-29.





RADIAL AND UPRIGHT DRILLING MACHINES

CINNATI BICKFORD TOOL CO.

Hydro-Line Air-Oil Cylinders

The Hydro-Line Mfg. Co., Rockford, Ill., has introduced its Series "S" combination air-oil cylinders with operating pressures

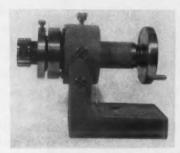


up to 1000 pounds per square inch. The units comply with J.I.C. pneumatic and hydraulic standards. A single cartridge in which the piston-rod seal and rod wiper are mounted is easily removed to replace seals or wiper when required. The new cushion design prevents internal damage and excessive noise at high speeds. Cylinders in the series are offered in bore sizes from 1 1/2 to 8 inches, and in seven different mounting styles. Any stroke length is available.

Circle Item 146 on postcard, page 257

Radial Relief Grinder for Small Tools

A device for grinding radial relief on small tools having up to six flutes has been developed by the Atlantic Engineering & Mfg. Co., Inc., Worcester, Mass. It can be used for both right- and left-hand taps, and for reamers, countersinks, drills, and engraving tools. Two Jacobs Rubber-Flex collets are provided, giving a shank capacity of 1/2 inch. A cam arrangement provides a means for vary-



ing the amount of relief to be ground. Rotation of a handwheel advances each flute into grinding position.

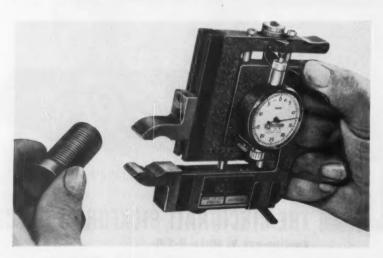
Circle Item 147 on postcard, page 257

Standard Gage Versa-Dial

A multiple-purpose dial unit, the Versa-Dial, is announced by the Standard Gage Co., Inc., Poughkeepsie, N. Y., for use in checking internal and external threads, grooves, shallow counterbores, and narrow shoulders. Interchangeable segments for contacting the work surfaces to be measured are secured in T-slots at the desired spacing. Movement of a

sliding section of the gage actuates the indicator directly without intermediate linkages. To interchange the unit between external and internal usage, it is only necessary to reverse the indicator, relocate a spring, and attach or detach a lifting lever. The gage indicator has 0.001, 0.0005, or 0.0001 inch graduations.

Circle Item 148 on postcard, page 257





Lufkin Tape Rule

A heavy-duty tape rule, with a 3/4-inch wide line, has been announced by the Lufkin Rule Co., Saginaw, Mich. The rule, called "Super Mezurall," is available with either a white or chromeclad blade. A light-weight, diecast magnesium-alloy case is provided. The rule is marked in both feet and inches. Graduations of 1/32 inch are provided for the first 12 inches, with graduations of 1/16 inch for the remainder of the tape. There is a heavy black diamond every 16 inches which indicates the location of studding. A long, wide, end hook is selfadjusting for end measurements.

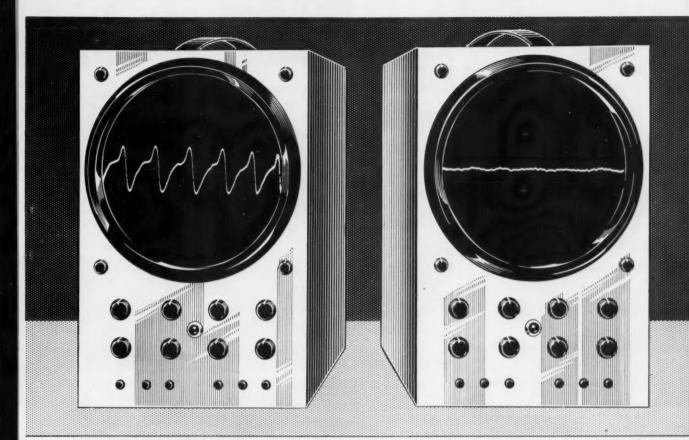
Circle Item 149 on postcard, page 257



Class XXX Plug Gages

Chromium-plated steel and carbide plug gages having a tolerance of 0.00001 inch are being introduced by the Van Keuren Co., Watertown, Mass. The gages, given the new designation of Class XXX, have a tolerance of one-half of Class XX gages. Tolerances may be applied either bilaterally or unilaterally. Wire type gages are available in tungsten carbide from 0.010 to 0.365 inch, and in chromium-plated steel from 0.010 to 1.010 inches. Taper-lock type gages are available in chromiumplated steel from 0.010 to 1.510 inches and in chromium carbide from 0.365 to 1.510 inches.

Circle Item 150 on postcard, page 257



WHEN A STRAIGHT MINERAL OIL was used to lubricate the ways, an 0.0008" jump at frequency of 2.74 cycles per second was noted.

WHEN SUNOCO WAY LUBRICANT was used on the ways, the jump was too small to measure, proof that this medium stops slip-stick motion.

TEST PROVES SUNOCO WAY LUBRICANT ENDS SLIP-STICK TABLE MOTION

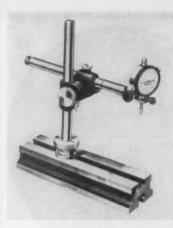
How effectively Sunoco Way Lubricant stops slip-stick table motion is graphically illustrated by these oscillograms. The pattern on the left was made with a straight mineral oil as the lubricant; the other was made with Sunoco Way Lubricant on the ways. Both patterns are magnifications of changes in rate of table travel and were obtained under identical conditions.

You can stop slip-stick table motion, protect the ways, get better surface finishes, cut production losses with Sunoco Way Lubricant. Try it in your shop. For more information, call your nearest Sun office or write Sun Oil Company, Philadelphia 3, Pa., Dept. M-3.

SUN OIL COMPANY



PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL Refiners of the famous Blue Sunoco Gasoline and Dynalube Motor Oils



Starrett Heavy-Duty Indicator

Extreme rigidity and universal adjustment are features found in the No. 675 heavy-duty dial test indicator made by the L. S. Starrett Co., Athol, Mass. Cast-iron base of the device has ground top and bottom faces, with a T-slot for attachment to machine tables. The post slides in a dovetail and can be secured at any point along the base by a large knurled screw. Angular adjustments can be made in both horizontal and vertical planes. Final positioning of the indicator is by a sensitive adjust-

ment at the end of the gage rod. A special clamp permits facing the indicator in any direction.

Circle Item 151 on postcard, page 257





Federal Air-Mechanical Gage

Concentricity and squareness checks on refrigerator compressor cylinder housings are made with an air-mechanical gage built by the Federal Products Corporation, Providence, R. I. A dial indicator checks the concentricity of a large counterbore; and the air unit—a 5000× Dimensionair—checks the

Barcol Small Motors

A line of unidirectional small motors combining high starting torque with high power output is being offered by Barber-Colman Co., Rockford, Ill. They are designated Barcol YAF motors, and are available in three stack thick-

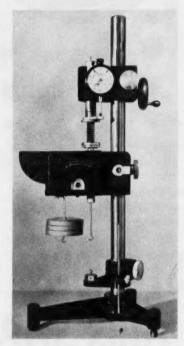
nesses and nine power ratings from 1/200 to 1/40 H.P. Typical application of these small size units is found in industrial instruments, servo-mechanisms, and small pumps.

Circle Item 153 on postcard, page 257



squareness of the cylinder bores with the bearing axis. This axis serves as a reference for both inspections. A dual expanding mandrel is located in the bearings, and is positioned on V-blocks. After the part has been rotated to place the cylinder bores in gaging position, it is locked on the mandrel. The squareness plug, equipped with a Federal AirProbe, is rotated, and the result read on the dial of the Dimensionair. Then, the mandrel locks are released, and the part rotated while the dial indicator unit establishes the degree of concentricity.

Circle Item 152 on postcard, page 257



Baldwin-Hunter Spring Tester

An improved Baldwin-Hunter spring tester featuring a new worm-gear drive, and with double its former capacity, is announced by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. The head readily gives load-deflection curves both for compression springs, as shown, and for extension springs. A dial indicator is mounted on the adjustable head for measuring varying extension or compression, or may be mounted on the weighing head when the tester is used with the fixed head for determining forces exerted by springs at a specified

(Continued on page 250)



图1.图

7/10 MINUTE FOR 118 TEETH

-Stacked back to back, two 6" diameter blanks have 59 teeth on each formed in 0.70 minutes on this SHEAR-SPEED gear shaper, in a large gear plant. Loading time is held to a minimum with automatic hydraulic clamping.

TRUE RADIUS FILLETS—True .070" radius fillets (for maximum strength) at the base of each spur tooth are formed simultaneously on these 17-tooth gears. The 7/9 diametral pitch 11/4" face width countershaft gears are cut on two SHEAR-SPEED gear shapers manned by one operator on a truck gear production line.

12 SECONDS FOR FINISHING—Floor to floor shaving time on these overdrive pinions is 12 seconds. Operator loads the chute through the size control fixture, the rest of the cycle is automatic. Average production is 40,000 pieces between cutter sharpenings. Stock removal is 0.003-0.005" over pins.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. . DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO., LTD.



From the invention of the combination square to a line of more than 3000 fine tools. From a room in a small machine shop to the largest manufacturing plant in the world devoted exclusively to the production of mechanic's hand measuring tools and precision instruments, dial indicators, hacksaws, band saws, band knives and precision ground die and flat stock. This is the contribution made to industry and to millions of skilled craftsmen by Laroy S. Starrett and the company which he founded.

On the occasion of our 75th Anniversary Year, the many Industrial Supply Distributors who make STARRETT products available to you through a convenient and reliable source of supply join us in our pledge to maintain and increase the STARRETT reputation for quality and precision — and for prompt, dependable service.

VISIT THE STARRETT EXHIBITS: Space 765, ASTE Western Industrial Exposition • Space 630, Western Metal Exposition



"WORLD'S GREATEST TOOLMAKERS"

AMERICAN STANDARD BUTTRESS SCREW THREADS-6

Appendix A-Symbols and Formulas

	Maximum Metal Basic	Minimum Metal
Nominal major diameter	D	
Height of sharp-V thread	H = 0.89064p	(see footnote)
Basic height of thread	h = 0.6p	3.6" A AGEW.
Root radius	r = 0.07141p	Minimum r = 0.0357p
Root truncation	s = 0.08261p	Minimum $s = \text{maximum } s \div 2 = 0.0413p$
Allowance	G L - L C.O	Minimum 1 1 (1/0 t-1 1 1
Depth of engagement	$h_{\bullet} = h - G \div 2$	Minimum $h_{\bullet} = \text{maximum } h_{\bullet} - (1/2 \text{ tolerance on major diameter screw} + 1/2 \text{ tolerance on minor diameter nut})$
Crest truncation	f = 0.14532p	
Crest width	F = 0.16316p	
Major diameter of nut	$D_n = D + 0.12542p$	Maximum $D_n = \text{maximum pitch diameter of nut} + 0.80803p$
Minor diameter of screw	$K_s = D - 1.32542p - G$	Minimum $K_{\bullet} = \text{minimum pitch diameter of screw} - 0.80803p$
Height of thread in nut	$h_n = 0.66271p$	
Height of thread in screw	$k_{\bullet} = 0.66271p$	

Note: The formulas for "Minimum Metal" given above apply when an adequate wall thickness is provided beyond the roots of the threads. For buttress threads on relatively thin-walled tubing the root truncation s=0.08261p may be taken as the minimum truncation and the maximum truncation recommended is 0.08261p+G+2. This will give maximum $D_B=$ maximum pitch diameter of nut +

0.72542p and minimum K_S = minimum pitch diameter of screw -0.72542p. In order to avoid contact between the crest corners of "GO" thread gages and the maximum root radius, the crest corners on the pressure flank side of "GO" thread gages should be beveled a radial distance approximately equal to G+2.

Appendix B-Pitch Diameter Equivalents for Pitch and Angle Errors

(a) PITCH ERRORS. An error in the pitch of a buttress thread virtually increases the pitch (effective) diameter of an external thread and decreases the pitch (effective) diameter of an internal thread.

If δp represents the maximum error in the axial displacement (pitch error) between any two points on a buttress thread within the length of engagement, the corresponding virtual increase in the pitch (effective) diameter of the external thread (or decrease for the internal thread) is given by the expression:

Virtual change in pitch (effective) diameter equals

$$\Delta E_{p} = \frac{2 \delta p}{\tan 45 \deg. + \tan 7 \deg.} = 1.781 \delta p$$

(b) ANGLE ERRORS. An error in one or both of the flank angles virtually increases the pitch (effective) diameter of an external thread and decreases the pitch (effective) diameter of an internal thread.

If δa_1 and δa_2 (in degrees) represent the errors

present in the two flanks (45 degrees and 7 degrees, respectively) of a buttress thread, the corresponding virtual change in pitch (effective) diameter is given by the following formula:

$$\Delta E_{\alpha} = 0.6p \left[\frac{\pm \tan (7 \deg. \pm \delta \alpha_2) \mp \tan 7 \deg.}{\tan (7 \deg. \pm \delta \alpha_1) + \tan 45 \deg.} + \frac{\pm \tan (45 \deg. \pm \delta \alpha_1) \mp \tan 45 \deg.}{\tan (45 \deg. \pm \delta \alpha_1) + \tan 7 \deg.} \right]$$

The values of $\Delta E_{1\alpha}$ obtained by the above formula do not differ greatly for plus and minus values for $\delta \alpha_1$ and $\delta \alpha_2$, when $\delta \alpha_1$ and $\delta \alpha_2$ are 1 degree or less and the following formula, in which the signs are disregarded, gives values closely approximating the values obtained by the above formula:

$$\Delta E_{\alpha} = p[0.009 \delta \alpha_3 + 0.019 \delta \alpha_1]$$

where $\delta \alpha_1$ and $\delta \alpha_2$ are in degrees or fraction of a degree.

Extracted from ASA B1.9-1958 with permission of publisher, American Society of Mechanical Engineers.

AMERICAN STANDARD BUTTRESS SCREW THREADS-7

Appendix C-Pitch Diameter Measurement*

Measurement of Pitch (Effective) Diameter of Buttress Threads. The pitch (effective) diameter of a buttress thread plug gage may be determined from measurements over wires of equal diameter of known size, which contact the flanks of the thread on opposite sides of the thread plug. Two optional procedures are used in determining the pitch (effective) diameters from the readings over the wires, M_{w} .

(a) The comparator reading $M_{\rm so}$ over the wires is checked using a gage-block or combination as a master. Then, using the average diameter of the wires w as determined in accordance with the National Bureau of Standards Handbook H28, Screw Thread Standards for Federal Services, the pitch (effective) diameter E is computed using the formula

(1)
$$E = M_w + \frac{p}{\tan \alpha_1 + \tan \alpha_2} - w \left(1 + \csc \frac{\alpha_1 + \alpha_2}{2} \cos \frac{\alpha_1 - \alpha_2}{2} \right) - c$$

When $\alpha_1=45$ degrees and $\alpha_2=7$ degrees, this formula reduces to

$$E = M_w + 0.89064p - 3.15689 w - c$$

(b) In the optional method, a reading M_D is taken over the wires placed on either side of a plain cylindrical gage of known diameter D. Then, the distance T between the wires as seated in the threads of the thread plug is computed by the formula

$$T = D - M_D + M_w$$

and the formula for pitch (effective) diameter E becomes

(2)
$$E = T + \frac{p}{\tan \alpha_1 + \tan \alpha_2} - w \left(\csc \frac{\alpha_1 + \alpha_2}{2} \cos \frac{\alpha_1 - \alpha_2}{2} - 1 \right) - c$$

D should be slightly smaller than the major diameter of the thread plug gage to be measured.

or E = T + 0.89064p - 1.15689 w - a

In both Formulas (1) and (2), c is a correction depending on the angle the wires make with a plane perpendicular to the axis of the thread plug gage. For all combinations of diameters and pitches listed in Tables 2, 3, and 4 † in this standard, c is less than 0.0004 inch, and it is recommended that the wire angle correction be neglected for these combinations and all other single-thread buttress thread plug gages.

Wire Sizes. In order to eliminate the effect of angle errors of the thread form on the calculated pitch (effective) diameter, the "best size" wires, for symmetrical threads, should contact the flanks of the thread at the pitch line. Due to the wide difference in the flank angles of a buttress thread, it is impossible for the thread-measuring wires to contact both flanks simultaneously at the pitch line.

An error in the angle α_1 of the trailing flank has approximately twice the effect on the pitch diameter calculated from readings over wires as the same angle error on the pressure flank α_2 . (See last formula for ΔE_{α} in Appendix B.) For this reason, it has been decided that the "best size" wire should contact the pressure flank at a point twice the distance above the pitch line that the contact point on the trailing flank is below the pitch line.

Table 5. Buttress Screw Threads

Diameters of Thread-Measuring Wires, "Best" and "Maximum"

Projection of Wires Above Naminal Creek

Threads per Inch	Pitch,	"Best" Wire Diameter, w = 0.54147p	Projection, $a = 0.1094p$	"Max" Wire Diameter, w = 0.61433p	Projection, $a' = 0.2244$		
16 0.062 12 0.083 10 0.100	0.05000 0.06250 0.08333 0.10000 0.12500	0.02707 0.03384 0.04512 0.05415 0.06768	0.0055 0.0068 0.0091 0.0109 0.0137	0.03072 0.03840 0.05119 0.06143 0.07679	0.0112 0.0140 0.0187 0.0224 0.0280		
6	0.16667	0.09024	0.0182	0.10239	0.0374		
5	0.20000	0.10829	0.0219	0.12287	0.0449		
4	0.25000	0.13537	0.0274	0.15358	0.0561		
3	0.33333	0.18049	0.0364	0.20478	0.0747		
2 ½	0.40000	0.21659	0.0438	0.24573	0.0898		
2	0.50000	0.27074	0.0547	0.30716	0.1122		
1 ½	0.66667	0.36098	0.0729	0.40955	0.1496		
1 ¼	0.80000	0.43318	0.0875	0.49146	0.1795		
1 ¼	1.00000	0.54147	0.1094	0.61433	0.2244		

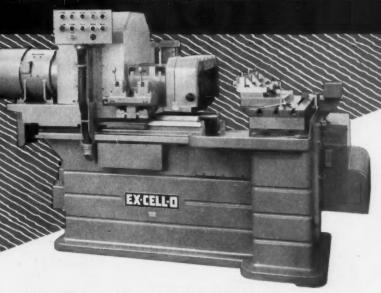
All dimensions are given in inches.

Continued in MACHINERY's Data Sheet for April, 1955
 See MACHINERY's Data Sheet for February, 1965.

Extracted from ASA B1.9-1958 with permission of publisher, American Society of Mechanical Engineers.

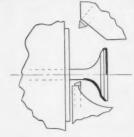
NEW EX-GELL-O MACHINE

contours valves by direct cam action (no levers)



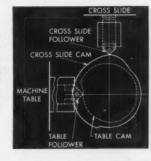
NEW EX-CELL-O CAM BORING MACHINE, Style 312, equipped with two spindles and tooling for operations on valve heads.

VALVES ARE CON-TOURED, faced, turned, and taper-turned. This drawing shows the two tools used in each station. The paths they follow on the workpiece are indicated in heavy lines.



Ex-Cell-O's new Style 312 Precision Boring Machine operates with direct cam action—is fast, accurate, automatic—is solid and rugged to handle tough jobs of precision contouring, boring, turning, facing, and grooving. For full information contact your Ex-Cell-O representative or write Ex-Cell-O in Detroit.

CONTOURING AC-TION: Cams act directly on the slide— NO LEVERS. Separate cams for table and for cross slide are both on one shaft, giving exact co-ordination.





CAMS CHANGED IN MINUTES: Cam assembly swings out for quick change of operation. All motors are outside the base.



CHIPS, COOLANT CANNOT ENTER THE BASE. Large chip chute is cast integral with the solid top of the heavy nickel iron base.



55-1

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

deflection. Loads are indicated by a scale on the weighing head which contains a precision beam and counterbalance system with a weight pan. The tester can also measure spring length up to 12 inches at a specified load.

Circle Item 155 on postcard, page 257



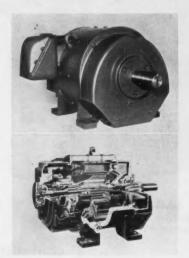
SPS Lock-Nut Designed for Oil-Field Applications

Oil-field operational demands for a fastener capable of withstanding excessive tightening torques and stresses of drilling rigs and allied equipment have been met by a lock-nut placed on the market by Standard Pressed Steel Co., Jenkintown, Pa. This latest member of the Flexloc line is manufactured with eight threads to the inch. The primary advantage of the eight-thread series is the high locking pressure secured without excessive tightening. Sizes ranging from 1 to 2 inches in diameter, with 1/8-inch steps, are obtain-

Circle Item 156 on postcard, page 257

Reliance Super "T" Motors

A complete line of direct-current industrial motors, called the Super "T" line, has been introduced by the Reliance Electric & Engineering Co., Cleveland, Ohio. The motors react with controlled "dynamic response," a feature built into the new line of motors to meet industry's demands for automation. The line features ruggedness, ability to take over-loads, rapid change of speed, maintenance of torque and tension, and quick reversing and stopping. The



time required for the motors to accelerate to full speed has been cut to half that formerly required. Sizes range from 20 to 100 H.P.

Circle Item 157 on postcard, page 257

Stainless-Steel Blade for Combination Squares

A 12-inch-long blade for use with combination squares and sets has been brought out by the Brown & Sharpe Mfg. Co., Providence, R. I. Black graduations are easily read

against the smooth finish of the stainless-steel blade. It is not affected by moisture, perspiration, acid, or corrosion-causing agents. Circle Item 158 on postcard, page 257





Ingersoll-Rand Impactool

A rotary electric nut-runner, identified as a Size 5U Impactool, announced by Ingersoll-Rand Co., New York City. The tool has a 1/2-inch square drive, and weighs 61/2 pounds. Developed to meet the nut-running requirements of automotive engines, it can also be readily adapted for drilling, screwdriving, wire-brushing, and hole-sawing, for example. A renewable synthetic rubber bumper on the front housing prevents dirt from entering around the driver. The tool has a rated free speed of 1900 R.P.M., and is designed to deliver an impact blow with each revolution.

Circle Item 159 on postcard, page 257



Card Precision Gages

S. W. Card Mfg. Co., Division of Union Twist Drill Co., Mansfield, Mass., has brought out a full line of precision gages for fine-tolerance work in industries requiring precision measurements. Types of gages to be stocked include reversible thread plug, plain cylindrical plug, reversible wire type plug, taper-lock thread plug, thread ring, and cylindrical ring.

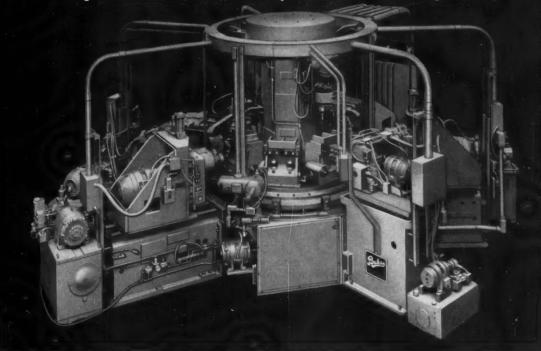
Circle Item 160 on postcard, page 257

ANOTHER EXAMPLE of REDUCING COSTS WITH-

Bulits

ECONOMATION

Mills, core-drills, drills, semi-finish bores, chamfers and taps 288 master-brake cylinders an hour gross!



Rough castings are loaded in pairs in this 10-way 7-station hydraulic-feed center-column Machine.

Equipped with 72"-diameter 7-position automatic power-driven heavy-duty index table, complete with two shot bolts.

For extreme ease of servicing and maintenance, automatic indexing unit slides out without removing table. This is done simply by detaching cover on front of Machine.

Other features of Machine include automatic hold-down clamp at rough-and-finish milling station, automatic rotating chip conveyor, power clamping and automatic lubrication.



Buhrs
MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

Let us show you how Buhr Economation can reduce your production costs. A phone call, wire or letter will bring you a prompt consultation with one of our top sales executives.

BUHR MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers



Hazel, the Howling Dervish

After Hurricane Hazel reduced the sea spray corrosion test lot of the International Nickel Co., Inc., at Kure Beach, N. C., to a shambles, United States Marines from Camp Lejeune assisted in the search for thousands of valuable specimens buried deep in the sand. Some of the specimens had been under test for fifteen years. Inco engineers are convinced, however, that testing under natural conditions, despite all the risks entailed, is still better than trying to draw proper conclusions from accelerated laboratory tests. So the station is now being rebuilt and enlarged.

And Rabbits in Brass Hats?

Two magicians were hired by the Scovill Mfg. Co., Waterbury, Conn., to perform a score of tricks using brass rod, wire, strip, and tube in its booth at the National Metal Exposition held in Chicago not too long ago. It must be more difficult to make a brass rod disappear than a silk handkerchief.

A Tip Straight from the Finger-Tips

Called upon to mark ceramic magnets, an unusual identification job, engineers at the Carboloy Department of General Electric Co. found that the red nail polish borrowed from one of the ladies in the company's industrial library served the purpose admirably because it was more "chippable"—the very quality that sends women to the manicurist weekly.

Tape a Cake

How to make a cake by automation was shown at the International Automation Exposition

held a while ago in New York City. We are mentioning it at this time because we want Between Grinds to get in on the theme of automation which is the keynote of MACHINERY this month. The demonstration was made by Magnecord, Inc., using a magnetic tape recorder-playback machine to measure, combine, and mix the ingredients in proper amounts and sequence. The entire operation required about three minutes. With additional accessories, such as mixers, the same tape message could simultaneously make dozens, or even hundreds of cakes, it was

On a Sunday Afternoon

Last November when General Motors celebrated the 50 millionth car built since its organization in 1908, the statement was made that if the automobiles were lined up bumper to bumper, they would wrap around the earth six times.

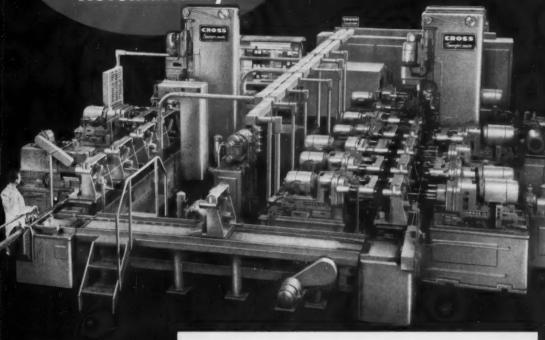


HERBERT HOOVER receiving the Silver Quill Award from Vice-President Nixon at a dinner given in Washington on December 29 by the National Business Publications, Inc. The former President of the United States was honored for most distinguished services to business and industry. Robert E. Harper, president of NBP, is seen at the left and Harvey Conover, chairman of the Board, NBP, and president of Conover-Mast

Publications, Inc., at the right.

Machines
Flywheel Housings
and Changes Set Up
Automatically

Another Transfer-matic by Cross





- Flexibility for scheduling because either part may be produced as required—set up changes and proper tools are selected automatically at each station.
- * 170 pieces at 100% efficiency.
- * 49 drilling, 22 chamfering, 4 reaming, 2 counterboring, 2 boring, 30 inspecting, and 30 tapping operations.
- * Palletized work holding fixtures with automatic transfer from station to station.
- * Hydraulic power wrench for clamping parts.
- ★ Other features: Complete interchangeability of all standard and spectial parts for easy maintenance; construction to J.I.C. standards; hardened and ground ways; hydraulic feed and rapid traverse; automatic lubrication.

Established 1898

THE CROSS

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

A Mechanical Eye Cross to Watch Your Tools **Machine Control Unit-Key to Automation** U.S. Patent Nos. 2679038 d D-163935, Others Pending The greatly increased number of tools used in modern transfertype machines makes adequate tool control a "must." The Cross Machine Control Unit was developed to meet this need-to cut downtime by programming tool changes . . . to reduce tool expense. The Cross Machine Control Unit is equipped with Toolometers which furnish a visual record of used and unused tool life and automatically stop the machine when tools need changing. Other tools almost used up are replaced at the same time. This grouping of changes, plus the availability of pre-set tools which are stored in the Machine Control Unit, reduces downtime. And downtime for machine adjustments and trial cuts is eliminated because standard fixtures and gages are provided for pre-setting the tools. Over 500 Cross Machine Control Units now in use are evidence of cost saving benefits. Get full information today. Established 1898

MACHINE TOOLS

CO.

MOUNS OF THE INDUSTRY

California

E. W. BLISS Co., Canton, Ohio, recently established sales offices at 816 N. Hollywood Way, Burbank, Calif., to supplement their West Coast Division. M. Frank Strauss and Donald C. Walker have been assigned to the Burbank office.

RUSSELL J. GEITMAN has been appointed chief engineer for the Link-Belt Co., San Francisco, Calif., at the 400 Paul Ave. plant in San Francisco. Mr. Geitman has been associated with the company for twenty-seven years.

NOBUR MFG. Co., Burbank, Calif., has appointed two factory representatives: HAROLD M. SMITH, to serve northern New Jersey; OTTO SCHMIDT to serve Wisconsin and northern Illinois.

HOWARD N. FARMER, JR., has joined the West Coast technical field section of the International Nickel Co., Inc., New York City, as a member of the Development and Research Division at Los Angeles, Calif.

GAIRING TOOL Co., Detroit, Mich., announces the appointment of AL-LIED TOOL & ABRASIVE Co., 3314 Fruitland Ave., Los Angeles, Calif., as distributors in southern California.

Illinois and Indiana

SUNDSTRAND MACHINE TOOL Co., Rockford, Ill., has constructed a plant near the main factory to house the newly formed Sundstrand Hydraulic Division. The following executive appointments for the division have been announced: A. H. SWENSON, manager; C. W. LANG, sales manager; F. E. CARLSON, chief engineer; R. W. ROPER, manager of manufacturing; G. N. BOOKLAND, purchasing agent.

GARDNER-DENVER Co., Quincy, Ill., has consolidated with the KELLER Tool. Co., Grand Haven, Mich. The Keller Tool Co. now becomes the Keller Tool Division of Gardner-Denver Co., and will continue operations under the former Keller management. E. V. ERICKSON, former president of Keller Tool Co., has been elected executive vice-president of Gardner-Denver Co.

ATWOOD FULLER has become sales engineer in the Chicago area of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. He will also represent the company in Indiana, northern Illinois, Wisconsin, Minnesota, and Iowa. Mr. Fuller's office is located at 627 Railway Exchange Bldg., 80 E. Jackson Blvd., Chicago, Ill.

JOHN B. DEMPSEY has been named manager of the electric tool sales of Thor Power Tool Co., Aurora, Ill. Mr. Dempsey, who has been with the company since 1938, was previously Detroit branch manager.

DELWYN A. MARQUETTE has been placed in charge of sales in the Midwest by the Webb Wire Division of the Carpenter Steel Co., New Brunswick, N. J. He will be located in Chicago, Ill.

THOMAS J. KELLEHER, general sales manager and secretary of the Dreis & Krump Mfg. Co., Chicago, Ill., has retired after forty-five years of service.

AMERICAN BRASS Co., Terre Haute, Ind., wholly-owned subsidiary of Anaconda Copper Mining Co., is constructing an aluminum plant on the outskirts of Terre Haute that will cost about \$25,000,000. James F. Ackerman, currently serving as vice-president of the Torrington, Conn. plant, will be in charge of the new aluminum fabricating operation in Terre Haute.

ROBERT M. ZIMMERMAN has joined the Atkins Saw Division, Indianapolis, Ind., of the Borg-Warner Corporation, Chicago, Ill., in the capacity of general manager of operations. Mr. Zimmerman was formerly general manager of the Delog Hook and Eye Co., and has had an extensive background in engineering and manufacturing.

B. J. MILLEVILLE has been named chief engineer at Edward Valves, Inc., East Chicago, Ind., subsidiary of Rockwell Mfg. Co. He was formerly assistant chief engineer.

Michigan, Minnesota, and Wisconsin

RALPH E. CROSS, executive vicepresident of The Cross Company, Detroit, Mich., has been appointed technical consultant to Roger Lewis, assistant secretary of the Air Force for Materiel. In this position, Mr. Cross will assist in developing an \$85,000,000 reserve of machine tools for aircraft production. He has just finished a one-year term as assistant administrator of the Business and Defense Services Administration of the Department of Commerce.

R. J. STUDDERS, magnet development engineer in the Carboloy Department of General Electric Co., Detroit, Mich., has been named manager of magnetic products engineering. Mr. Studders, who has been with Carboloy since 1950, began his career with the General Electric Co. in 1944 as a magnet engineer. He replaces E. E. GEORGE, who has been appointed plant manager of Carboloy Department's Edmore, Mich., permanent magnet plant.

J. MILTON WELLS has been appointed manager of the Detroit, Mich., office of the Motch & Merryweather Machinery Co., Cleveland, Ohio, and ROBERT L. MORRISON has been made assistant manager. They succeed EDWARD F. LICKEY and ERNEST A. GUNTRUM, veterans of thirty-seven and forty-two years' service, respectively. The Detroit office was recently moved to 23520 Woodward Ave., Ferndale.

SUPER TOOL Co., Detroit, Mich., has opened a plant in Elk Rapids, Mich., for the production of standard carbide drills, reamers, milling cutters, saws, lathe tools and other metal cutting tools, and a line of masonry and glass drills. In addition, the company has a new factory branch and warehouse at Glendale, Calif., and warehouses in New York and Chicago.

John A. Clements has been named supervisor of manufacturing methods and time standards in the Carboloy Department of General Electric Co., Detroit, Mich. Mr. Clements formerly was supervisor of methods and time standards of General Electric's Electronics Division of the Buffalo Tube Plant.

NATIONAL TWIST DRILL & TOOL Co., Rochester, Mich., announces the purchase of assets of the STAPLES TOOL Co., Cincinnati, Ohio. No significant changes will be made in the

(Continued on page 262)

you get more powerful

with CP Universal Electric Impact Wrenches

That's right! CP's new Electric Impact Wrench develops 2000 powerful blows a minute! Its hard-hitting impact action gets more work done ... runs nuts or screws faster and easier than ever before possible. And consider all these other design features that are "built-in" the CP-903R to afford tops in operating ease, safety, and dependability:

Slim Profile – the narrow, 2" diameter nose permits easy access into tight spots.

Centered Pistol Grip and reverse switch in the handle afford simple one-hand operation.

Reverse Switch Interlock — prevents reversing while wrench is in operation.

"Unitized" Motor — resists vibration . . . assures long, trouble-free service life.

Bonus Capacity — while it's rated at 3/8" bolt size capacity, the CP-903R has in most cases a bonus rating up to 5/8" capacity.

Write for information.





PNEUMATIC TOOLS . AIR COMPRESSORS . ELECTRIC TOOLS . DIESEL ENGINES . ROCK DRILLS . HYDRAULIC TOOLS . VACUUM PUMPS . AVIATION ACCESSORIES

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

STANDARD GAGES—Sheffield Corporation, Dayton, Ohio. Catalogue No. LTG-54, 51 pages giving complete information on Sheffield limit type gages. Sectionalized and spirally-bound, the manual gives data on cylindrical gages, tapered-plug and ring gages, plain cylindrical-ring gages, adjustable-limit gages, thread gages. Engineering data and specifications are included. Can be obtained on request direct to the above address.

TURBINE-GENERATORS—General Electric Co., Schenectady 5, N. Y. Bulletin GEA-3277C, 54-page booklet covering in detail condensing and non-condensing applications for electric utilities and industrial plants, as well as special turbine applications. Operation of the governing system, valve gears, ventilating and cooling systems, modifications of the basic standard design to meet special requirements, and design and manufacturing features are discussed. Also included are diagrams, photographs, drawings describing applications and features of straight condensing and non-condensing steam

INDEX TABLES—Roller Gear Division of Ferguson Machine & Tool Co., Inc., St. Louis, Mo. Catalogue 300, containing 12 pages of illustrated information on the Intermittor, standard precision index tables for high-speed production. Booklet provides assembled drawings, tables of load ratings and dimensions of over 150 models and data on the indexing mechanism—a Ferguson roller gear drive. . . 3

PLAIN GRINDER—Landis Tool Co., Waynesboro, Pa. Catalogue B-54 containing detailed information on the Landis 10-inch and 14-inch plain hydraulic cylindrical grinding machines used extensively for high production grinding aswell as for short runs and featuring pressure lubricated Microsphere wheel spindle bearings. Included are specifications, extra equipment and typical grinding operations.

HANDLING AND STORAGE OF PARTS AND MATERIALS—Stackbin Corporation, Pawtucket, R. I. Catalogue 504, consisting of 20 pages complete with diagrams and tables explaining the method used for handling and storage, and describing in detail the complete line of Stackbins, Stackracks, pallets, movable bases, Stackshelves, assembly bins, nail bins, and tool storage equipment. . . . 6

PNEUMATIC RIVETING AND DIMPLING MACHINES—Lemert Engineering Co., Inc., Plymouth, Ind. Folder containing detailed information on Airflex rotating-impact principle with spinning action, plus four control factors, as well as data explaining design, performance, and markets of Airflex machines for such cold-flow operations as riveting, swaging, flaring, reducing, enlarging, and aircraft dimpling.

TOOLING FOR WELDING—Cecil C. Peck Co., Cleveland, Ohio. 40-page publication illustrating and describing standard and special tooling, fixtures and machinery for high-quality, high-speed, low-cost welding, and including examples of special purpose automatic welding ma-

FIRST CLASS Permit No. 53 (Sec. 34.9, P. L. & R.) New York, N. Y.

BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY-

MACHINERY

93 WORTH STREET NEW YORK 13, N. Y.

READERS' SERVICE DEPT.



STEEL STOCK LIST—Supply Division of the United States Steel Corporation, Chicago, Ill. Data covering entire United States Steel Supply Division line and combining four books in one binding. Items are classified and cross-referenced under following sections: special metals, industrial supplies, prices-references and carbon steels.

CHUCK JAWS—Skinner Chuck Co., New Britain, Conn. Bulletin SJ-67, giving price list on complete line of soft blank top jaws, and describing medium- and heavy-duty tongue, groove, and serrated type jaws with American standard drilling and cross keys, serrated keys for chucks, and slip jaws for two-jaw box body chucks. 14

REINFORCED PLASTICS—Bakelite Co., Division of Union Carbide and Carbon Corporation, New York City. Brochure describing and illustrating the ways in which structural strength and economy of manufacture are obtained by designing reinforced plastics with Bakelite polyester resins.

BARREL FINISHING—Minnesota Mining and Mfg. Co., St. Paul, Minn. 10-page manual describing the basic steps involved in making trial processing runs and giving recommendations for barrel speeds, water level, time cycles, barrel loading, and for selection of media and compounds.

GEAR HOBBING MACHINES—Potter & Johnston Co., Pawtucket, R. I. Bulletin 156, giving data on hobbing machines for helical and herringbone gears, wormwheels, and spur gears. Brief descriptive material on helical control method, feed changes, power rapid traverse, tangent feed attachments, and construction. . . 18

GRINDING WHEELS—Nu-Matic Grinders, Inc., Cleveland, Ohio. Six-page folder describing complete line of Aircore grinding wheels and the various applications in finishing work of all types. Six standard models are listed along with a serrated drum and a drum spreader. 19

WIRE STRAIGHTENING CUTTING MA-CHINES—Lewis Machine Co., Cleveland, Ohio, Folder descriptive of the Lewis 2-C wire machines available in two wire size ranges—one No. 2-C3 for wire from 1/16 inch to 3/16 inch, and the other SPRING LOCK WASHERS — Spring Washer Institute, New York City. 16-page booklet descriptive of the engineering principles of spring lock washers and showing how tightness of assembled parts is developed, and how loss of tightness may be substantially reduced. 24

FORGED STEEL UNIONS—Watson-Stillman Fittings Division, H. K. Porter Co., Inc., New York City. Bulletin U-1, presenting complete dimensions of unions and the design features making them desirable for high-pressure piping service, for resistance to shock, and misalignment stresses. 26

ANGLE COMPARATOR—Perkin-Elmer Corporation, of Norwalk, Conn. 8-page illustrated brochure exhibiting in detail the setting up of the precision optical instrument and its use for such specific purposes as checking angles, surface flatness, and parallelism between two surfaces. 27

HYDRAULIC TRANSMISSION—Vickers Incorporated, Detroit, Mich. Bulletin 47-40B, outlining operational advantages and design features of the Series TR3 variable-speed transmission and presenting a chart of output speed ranges for various recommended input speeds...29

BRONZE ELECTRODE COMPARATIVE CHART—Ampco Metal, Inc., Milwaukee, Wis. Chart 54D-203, listing all known brands of aluminum-bronze, phosphorbronze, nickel-aluminum-bronze, and

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

_	15	29	43	57	101	115	129	143	3		PAGE	PAGE		NAME	TITLE	0	6	TI
N	=	30	:	Us 00	102	116	130	14	2	6 ∰					:	COMPANY	CO. ADDRESS	
	17	31	45	39	103	117	131	145	94	editorial	PRODUCT	PRODUCT	2	:	:		DRES	
	18	32	46	6	04	118	132	146	8				9	:	:	:		
Un.	19	33	47	6	105	119	133	147	5	od	õg.	000	7	:	:	:		
•	20	34	40	62	106	120	134	148	102	or advertising	ğ		# y	:	:	:	:	
7	21	35	49	63	107	121	135	149	2	sing			9	:	:	:	:	
•	22	36	50	6	108	122	136	150	2		:		nam	:	:			
•	23	37	51	65	109	123	137	151	8	pages,		:	9	:	:			
10	24	38	52	66	110	124	138	152	8	2			ď.		:			*
=	25	39	53	67	=======================================	125	139	153	107	5	:		Please print your name and address	:				: : :
7	26	40	54		112	126	140	154	8	Бе	:		Ē					:
-	27	-	55		113	127	141	155	169	belows								
=	20	42	56		=	128	142	156	170					*	*			

manganese bronze electrodes on the market for use in electrode selection. 30

TITANIUM TUBING—Superior Tube Co., Norristown, Pa. Bulletin 43, containing 8 pages of information on fabrication of unalloyed titanium tubing, including heat-treating, pickling, welding, brazing, and machining. Qualifications and applications are also included. . .31

STOCK GEARS—Universal Gear Works, Inc., Detroit, Mich. Comprehensive 200-page catalogue featuring 8000 stock items including gears, sprockets, chains, splines, and describing pictorially the manufacturing facilities of the factory. 33

SHELVING—Standard Pressed Steel Co., Jenkintown, Pa. 4-page folder containing information on the advantages of various types of Hallowell adjustable steel shelving, including open and closed, ledge or counter types with swinging or sliding doors. Describing multiple piercing and forming of all shelving parts. 36

VAPOR DEGREASING—Metalwash Machinery Corporation, Elizabeth, N. J. Booklet describing the solvent cycle, the vapor degreaser and spray, the liquid vapor degreaser and hydraulic lifter for batch type degreasers. There are illustrations of three basic machine types. . . 40

CASTING AND WROUGHT ALUMINUM ALLOYS—Reynolds Metals Co., Louisville, Ky. 16-page brochure covering

aluminum mill products and how to use them. Selection guides are provided. .46

PORTABLE BAND SAW—Johnson Mfg. Corporation, Albion, Mich. Leaflet giving specifications and construction features of Model M portable band sow. .49

PICKLING AIDS—E. F. Houghton & Co., Philadelphia, Pa. Bulletin describing two new pickling aids and a pickling in hibitor.

SANDBLAST MACHINE—Leiman Brothers, Inc., Newark, N. J. Bulletin 1555 consisting of four pages of information on complete line of sandblast machines, including standard cabinet type, upshot

PERST CLASS
Permit No. 53
(Sec. 34.9, P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY-

MACHINERY

93 WORTH STREET NEW YORK 13, N. Y.

READERS' SERVICE DEPT.



FIRST CLASS
Permit No. 53
(Sec. 34.9, P. L. & R.)
New York, N. Y.

BUSINESS REPLY CARD

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY-

MACHINERY

93 WORTH STREET NEW YORK 13, N. Y.

READERS' SERVICE DEPT.



WET SURFACE GRINDING MACHINE— Peterson Welding Laboratories, Inc., Kansas City, Mo. Catalogue 1955, describing and giving specifications for the Peterson universal wet surface grinding machine for grinding of heads, manifolds, and blocks from both in-line and V-8 type motors. This grinding machine is manufactured primarily for use in the automotive and industrial engine rebuilding trade. 53

WORK BENCHES AND SHOP AIDS— Sturdi-Bilt Steel Products, Inc., Chicago, Ill. 20-page general catalogue describing the Sturdi-Bilt line of industrial shop and consumer equipment; bulk bins, heavy-duty work benches, work bench accessories and shop aids, shop tenders, shop-tender accessories, machine stands, as-embly and welding fixture stands, machine and assembly-stand accessories. 54

PUNCHING PRESSES—Ferracute Machine Co., Bridgeton, N. J. Catalogue P-200 containing 4 pages of information on adjustable bed presses, and including specifications and illustrations. Advantages of friction clutch and positive clutch are explained, and outstanding features of the models are described in detail.

INDUSTRIAL EQUIPMENT—General Industrial Co., Chicago, III. Catalogue 3547, describing the company's industrial equipment such as the wireless inter-communication system which requires no wires and no installation, and giving information on the sizes and capacities of plastic drawer cabinets......58

GLASS-REINFORCED ACE MOLDED PLASTICS—American Hard Rubber Co., New York City. Catalogue GRP-1 describing custom-molded parts of ACE glass-reinforced plastics, and high-pressure molding techniques. Data is given on matched-die metal molding for mass production of relatively simple shapes. 59

HYDRAULIC CIRCUIT CONTROL MAN-IFOLDS—Almo Tool Co., Centerline, Mich. Brochure describing the operation and applications of hydraulic circuit control manifolds for hydraulically operated machines and showing how they have simplified machine design. 60

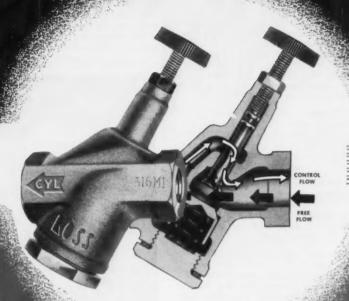
COLLETS—Hardinge Brothers, Inc., Elmira, N. Y. A collet selection guide for all lathes, millers and grinders, and featuring specifications and dimension charts, conversion and interchangeability listings. Prices are given in tabular form.

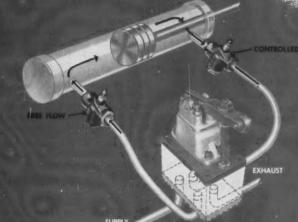
FLAT-BELT DRIVE—American Pulley Co., Philadelphia, Pa. Catalogue FBC-55-2 including specifications for steel split pulleys, hi-torque motor pulleys, shaft collars, shaft hangers and bearings, and American Econ-O-Matic motor bases.

9	0.	COMPANY	1	MAN	PAOL	PAGE	For	157 1	143 1	129 1	115 116	101 102			29		-	item numbers on
:	100	NA.		:	:		dito	58 1	1	30 1						-		num.
:	ESS				3:		Ē 0	59 1	65 1	91 1	17 1	2					w	500
:			:	:	2 2	R	or oll	6	1 9	32 1:	=	2	6	. 3	12		-	9
:		:	:		100	DOC	adve o	5	91	33 1:	19 1	2	2	47	25	3	u	1
:		:		:	7 4	4	1 D	52		34 1	20 1	06 1					•	which you
H	:	:	:		-	:	ing rodu	8	9 1	35 1	21 1	07 1					7	you wish further lafer
S	:	:	:	:		:	2 3	2	50 1	36 1	22 1	8					•	*
:		:	:	:	9	:	1 3	65 1	51 1	37 1	23 1	3					•	2
		:	:		8:	*	a ntion	6	52 1	38 1	24	10						1
A		:			9:	:		67 1	53 1	39 1	25	=	67					-
:	:	:	:	:	* :	:	5 F	2	54 1	40 1	26 1	12 1						wish further information.
					:		3 30	\$		41 1	27							mation.
				:			1 31	76	36	42	20	Ī		56	2		•	?
G G	8	co	m	E	74	PAG	For	157	143	129	115	101	57	43	29	15	_	7
	5	2		R				5	H	130	116	102	55	=	30	16	10	-
	2	3		:	3	:	0 2	159	145	131	117	103	59					item numbers on
:		:	:		1.		9 0	Š	146	132	=	2				18		3
	:	:	:	:	10	100		5	147	133	119	105						
	:	:	:		1 5	UCI	9 9	162	4	134	120	=						hid
	:				4:		pro	2	149	135	121	107		49			7	Ye
TOP	:			:	1	:	P ch	ž	150	136	122	0		50				
	:		*	:				165	151	137	123	109	65	51				which you wish further inform
	:		:	:	1		anti	166	152	138	124	=					10	3
118		:	:	:	1	*	in onec	167	153	139	125	=					11	1
3	*			1	1	*	belev	-	15		11	=		440		26		5
	ZONE STATE ZONE STATE	CO. ADDRESS ZONE	CO. ADDRESS ZONE	COMPANY CO. ADDRESS CO. ADDRESS ZONE ZONE	CO. ADDRESS ZONE ZONE	PRODUCT	PRODUCT PAGE PAGE PAGE PAGE PAGE PAGE PAGE PAGE	PRODUCT PRODUCT	of 161 162 163 164 165 166 167 168 169 170 stalls on products mentioned in March or advertising pages, fill in below: PRODUCT PRODUCT STATE ZONE STATE	46 147 148 149 150 151 132 153 154 135 156 46 161 162 163 164 165 166 167 168 169 170 broils on products mentioned in March or advertising pages, fill in below: PRODUCT PRODUCT STATE TONE TONE TONE STATE	32 133 134 135 136 137 138 139 140 141 142 46 147 148 149 150 151 132 153 154 155 156 40 161 162 163 164 165 166 167 168 169 170 atalis on products mentioned in March or advertising pages, fill in belown PRODUCT PRODUCT PROPUCT 32000 and address STATE 32000 STATE	18 119 120 121 122 123 124 125 126 127 128 22 123 134 135 136 137 138 139 140 141 142 24 64 147 148 149 150 151 152 153 154 155 135 60 161 162 163 164 165 166 167 168 169 170 products mentioned in March or advertising pages, fill in belows PRODUCT PRODUCT PRODUCT STATE 32000 3300 3300 3300 3300 3300 3300 33	04 105 106 107 108 109 110 111 112 113 114 18 119 120 121 122 123 124 125 126 127 128 22 123 134 135 136 137 138 139 140 141 142 46 147 148 149 150 151 152 153 154 155 156 60 161 162 163 164 165 166 167 168 169 170 PRODUCT PRODUCT PRODUCT See print your name and address STATE STATE	60 61 62 63 64 65 66 67 04 105 106 107 108 109 110 111 112 113 114 18 119 120 121 122 123 124 125 126 127 128 22 123 134 135 136 137 138 139 140 141 142 46 147 148 149 150 151 152 153 154 155 156 60 161 162 163 164 165 166 167 168 169 170 PRODUCT PRODUCT PRODUCT PROPUCT STATE 3200000000000000000000000000000000000	46 47 48 49 50 51 52 53 54 55 66 67 60 61 62 63 64 65 66 67 64 105 106 107 108 109 110 111 112 113 114 18 119 120 121 122 123 124 125 124 127 128 123 124 125 124 127 128 12 123 124 125 125 125 125 125 125 125 125 125 125	32 33 34 35 36 37 38 39 40 41 42 46 47 48 49 50 51 52 53 54 55 56 40 61 62 63 64 65 66 67 04 105 106 107 108 109 110 111 112 113 114 18 119 120 121 122 123 124 125 126 127 128 32 133 134 135 136 137 138 139 140 141 142 46 147 148 149 150 151 132 153 154 155 156 0 161 162 163 164 165 166 167 168 169 170 PRODUCT PRODUCT PRODUCT PRODUCT PRODUCT STATS STATS STATS	18 19 20 21 22 23 24 25 26 27 28 22 33 34 35 36 37 38 39 40 41 42 46 47 48 49 50 51 52 53 54 55 56 60 61 62 63 64 65 66 67 64 105 106 107 108 109 110 111 112 113 114 18 119 120 121 122 123 124 125 126 127 128 22 133 134 135 136 137 138 139 140 141 142 46 147 148 149 150 151 152 153 154 155 156 60 161 162 163 164 165 166 167 168 169 170 PRODUCT PRODUCT PRODUCT PRODUCT STATS STATS STATS STATS	4 5 6 7 8 9 10 11 12 13 14 18 19 20 21 22 23 24 25 26 27 28 22 33 34 35 36 37 38 39 40 41 42 46 47 48 49 50 51 52 53 54 55 56 40 61 62 63 64 65 66 67 48 105 106 107 108 109 110 111 112 113 114 18 119 120 121 122 123 124 125 126 127 128 22 123 124 125 126 137 138 139 140 141 142 46 147 148 149 150 151 132 133 134 135 136 40 161 162 163 164 165 166 167 168 169 170 PRODUCT PRODUCT PRODUCT TOWN nome omd address TOWN NOME OF TAKE PRODUCT TOWN NOME OF TAKE PRODUCT TOWN NOME OF TAKE TOWN NOME OF TA

For Precision Control...use

SPEED CONTROL VALVES





- Precise, simple adjustment
- · Compact
- Low maintenance
- Write for Bulletin 305A

Ross OPERATING VALVE COMPANY

110 EAST GOLDEN GATE, DETROIT 3, MICHIGAN

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-261

management, and Staples will continue to make and sell an expanded line of carbide-tipped tools under its own name.

DELTA WELDER CORPORATION, Detroit, Mich., is a newly organized firm specializing in the design, engineering, and building of completely automatic multiple-point welding machines, high-production special and standard resistance welding machines, and automation equipment.

SUPER TOOL Co., Detroit, Mich., has appointed NICK & PIERRO SALES Co. as agents for the Detroit area. The Nick & Pierro Sales Co. will handle the entire line of standard and special carbide metal cutting tools. This firm has had many years of experience in production with metal cutting tools.

ROBERT BARLEY has been named general sales manager by the Progressive Welder Sales Co., Detroit, Mich. He was formerly assistant sales manager. Mr. Barley has been with the company since 1942.

Ohio Knife Co., Cincinnati, Ohio, recently moved its Detroit office to 10600 Puritan, Detroit, Mich. Harold Shimpke and Donald De Land have been appointed representatives in the Detroit area.

BRYANT CHUCKING GRINDER Co., Springfield, Vt., announces the purchase of the HIGH PRODUCTION MACHINE Co., Philadelphia, Pa., by the E. G. Staude Mfg. Co., St. Paul, Minn., a wholly-owned subsidiary of Bryant. In the future all manufacturing and engineering will be done at the Staude plant in Minnesota.

GUTE Co., Milwaukee, Wis., has been appointed a representative for Reid surface grinders by REID BROTHERS Co., INC., Beverly, Mass.

Nebraska and Kansas

R. A. Hamilton was recently appointed manager of the Wichita Precision Tool Co., Wichita, Kans. In this capacity, Mr. Hamilton will coordinate all the production, research, and sales activities of the company.

R. K. LEBLOND MACHINE TOOL Co., Cincinnati, Ohio, has appointed the BALBACH Co., 1201 California St., Omaha, Neb., sales distributor for the eastern half of Nebraska and western Iowa to handle the complete line of LeBlond lathes and lathe attachments, as well as other leading makes of machine tools.

New England

GEARTRONICS, a Division of Technical Products Co., Inc., Concord, Mass., has been organized for research and development of precision instrument gears. T. W. KHIRALLA

is the president, and PROFESSOR EARLE BUCKINGHAM, technical and research director of the company. In addition to conducting basic research and experimental development, Geartronics will design and fabricate new products having unusual problems in the fields of gear drives, power transmission, instrument accuracy, or cost reduction.

LEONARD C. SCHMIDT has been named works manager in charge of tooling and production activities at Worcester Pressed Steel Co., Worcester, Mass. He was formerly manager of manufacturing methods at General Electric Co., Schenectady, N. Y.



Robert D. Lawson, who is vicepresident and sales manager for the Norton Co.

ROBERT D. LAWSON has been elected vice-president and sales manager of the Grinding Machine Division of the Norton Co., Worcester, Mass. Mr. Lawson has been associated with the company for thirty-six years.

E. A. TICE, a member of the corrosion engineering section of the development and research division of the International Nickel Co., Inc., New York City, has been transferred to the division's New England technical field section at Hartford, Conn. Mr. Tice joined the company in 1946.

BULLARD Co., Bridgeport, Conn., recently opened an exhibit building which consists of a demonstration room in which machines of various types are powered for demonstration. The adjacent auditorium has capacity for seating 150 persons.

FRANK J. WANDYES has been appointed plant superintendent for Henry G. Thompson & Son Co., New Haven, Conn. M. J. RABECKI has been named plant manager.



Paul A. Grobey, director of engineering and research of Bryant Chucking Grinder Co.

Paul A. Grobey has become director of engineering and research of the Bryant Chucking Grinder Co., Springfield, Vt. Mr. Grobey was previously director of research there. Since 1937 he has held various positions in the sales and engineering departments.

WIGGLESWORTH MACHINERY Co., East Boston, Mass., recently moved to a new location at 60 Border St., East Boston, Mass.

THE HARTFORD SPECIAL MACHINERY Co., Hartford, Conn., distributors of the Hartford Special Super-Spacer, has appointed the following representatives: WALTER H. BROOKE MACHINE TOOLS, 5740 W. Chicago Ave., Chicago, Ill., covering the greater Chicago area; MACHINIST TOOL Co., 103 Hall St., Rockford, Ill., covering the Rockford area; TOOL CRIB INC., 4221 Excelsior Blvd., St. Louis Park, Minneapolis, Minn., handling the Minneapolis-St. Paul area; and SHIVELY BROTHERS INC., 719 E. Second Ave., Flint, Mich., covering northern Michigan.

WALLACE E. Anderson has been appointed general sales manager of Brown & Sharpe Mfg. Co., Providence, R. I.

New York and New Jersey

THE CARBORUNDUM COMPANY, Niagara Falls, N. Y., has established a new operating unit, which will be known as the Electro Minerals Division, to manufacture and sell silicon carbide and fused alumina crudes, abrasive grain, and related electric furnace products in the United States. JOSEPH S. IMRIE, formerly assistant to the president, has been made general manager.

ELMES Double-Action DRAWING & FORMING PRESS

"Custom Built" for deep drawing of large high-pressure gas containers

The press shown at right is a typical example of the work of Elmes engineers in designing hydraulic equipment to meet special requirements. This press is located in the plant of one of the nation's largest producers of high-pressure gas containers. A variety of container sizes, made of special high strength alloy steel, are drawn to exacting dimensional specifications. The press must maintain uniformly accurate concentric diameters and wall thickness in the part.

Many important Elmes construction and control features are responsible for maintaining the high quality and efficiency of production on this type of heavy-piece, deep-draw work. Following are just a few of these features:

- Ring key positioning, assuring constantly maintained "all-directional" alignment of press crown, bed, and housings.
- Extra-long guide ways for main and blankholder slide, counteracting all tendency of the slide to deflect during pressing operation.
- Provision for extra-fine gib adjustment and slide alignment obtained by use of non-metallic facing on the gibs and hand-scraped bearing surfaces.
- Press equipped with a separate pumping unit for powering the blankholder system. Assures maintenance of the blankholder pressure irrespective of main slide movement.
- Individual corner pressure adjustment provided for blankholder slide.

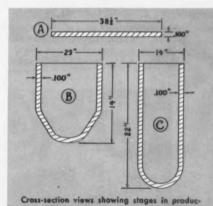
Elmes craftsmanship in press design and construction will assure *you* of press performance at its *best*. Recommendations and cost estimates will be promptly supplied, and entirely without obligation, of course. See your Elmes Distributor, or write to us direct.

Standard or Custom Built Presses for

DRAWING AND FORMING
FORCING BENDING
STRAIGHTENING
TUBE REDUCING FORGING
COINING DIE SINKING ETC



Elmes Double-Action Drawing & Forming Press, equipped with die cushion. Main platen capacity 300 tons, blankholder capacity 100 tons. For single-action operations of main platen and blankholder, capacities are combined for a total of 400 tons.



tion of high-pressure gas container bodies on the Elmes Double-Action Press illustrated above. The blank and first draw are produced in a single operation. (A) Circular blank. (B) First draw. (C) Final draw.

ELMES

AMERICAN STEEL FOUNDRIES • ELMES ENGINEERING DIVISION 1162 Tennessee Avenue... Cincinnati 29, Ohio

HYDRAULIC PRESSES & EQUIPMENT

METAL-WORKING PRESSES . PLASTICS MOLDING PRESSES . PUMPS . ACCUMULATORS

Other key promotions are as follows: GEORGE R. RAYNER, JR., sales manager; D. GEORGE VANDERHOEK, manufacturing manager; JOSEPH J. FOR-RESTER, manager of product engineering; HAROLD L. SCHMIDT, works manager of the Division's Niagara Falls plants; and ELMER E. How-ARD, manager of the Vancouver, Wash., plant. The Bonded Products and Grain Division in Niagara Falls, which formerly encompassed the responsibilities now allocated to the Electro Minerals Division, will be designated the Bonded Abrasives Division and will specialize in the manufacture and sales of grinding wheels, sharpening stones, and other bonded abrasives.

FEDERAL MACHINE & TOOL Co., INC., Long Island City, N. Y., has acquired the ATLANTIC CARBIDE Co. and the COLONIAL TOOL & CUTTER Co., both of Rochelle Park, N. J. The company will be known as the Federal Carbide & Cutter Co., Inc. and will be affiliated with Federal Machine & Tool Co., Inc., and the latter's subsidiary, Federal Services Co., which specializes in tool designing. ARTHUR ELLINS has been made president of Federal Carbide & Cutter Co., Inc.; Don DE SALVO, former owner of Colonial Tool & Cutter Co., has been made vice-president and treasurer; and A. B. ROSENBERG has been appointed vice-president and secretary. The company plans to concentrate on carbide and highspeed steels, giving a complete cutter grinding service, and converting standard tools into special tools, as well as manufacturing single-point and form tools.

ARTHUR E. STEHLE has become national sales manager of the Ettco Tool Co., Inc., Brooklyn, N. Y. He has been with the company since 1945, and has held various positions.



Arthur E. Stehle, national sales manager of Ettco Tool Co., Inc.

His former position as head of the Chicago sales office is now being filled by Otto Schmidt.

CLAYTON K. BAER has been named assistant to the manager of the tool steel sales division, Crucible Steel Company of America, Syracuse, N. Y. He has been with the company since 1941.

CHESLEY SOMERTON has been named assistant sales manager of the Wales-Strippit Corporation, North Tonawanda, N. Y. Mr. Somerton was formerly a sales engineer for Wales-Strippit of Canada, Ltd.

SIZE CONTROL Co., Chicago, Ill., of the American Gage & Machine Co., has appointed the ARTHUR J. VINCENT Co., New York City, as its sales representative in New York and New Jersey.

MICHAEL P. APOSTOLIK has become manager for the New York district sales office of the Wheeling Steel Corporation, Wheeling, W. Va. Mr. Apostolik has been with the firm since 1925. He succeeds HAROLD W. SCHROEDER who has retired from active service after thirty-nine years with the concern. Mr. Schroeder is being retained as a consultant.

LOUIS C. HAHN has been named sales representative, in the New York City area, by Federal Machine & Welder Co., Warren, Ohio. He will also handle the territory of Philadelphia, Pa. Offices are located at 550 Fifth Ave., New York, City, and 53 Long Lane, Upper Darby, Pa.

BENCHMASTER MFG. Co., Gardena, Calif., announces the opening of an East Coast office and warehouse to be known as the Benchmaster Parts Co. It will be located at 519 S. 5th Ave., Mount Vernon, N. Y., and will service the entire area east of the Mississippi.

GORDON R. PORTERFIELD has been named a representative of the New York territory by the Elmes Engineering Division of American Steel Foundries, Cincinnati, Ohio. Mr. Porterfield's offices are at 230 Park Ave., New York City.

Ohio

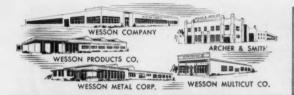
MOTCH & MERRYWEATHER MACHINERY Co., Cleveland, Ohio, recently made the following executive appointments: George E. Merryweather, chairman of the board and secretary, who will also serve as chairman of the executive committee; CHARLES B. LANSING, president; and CLARE R. KUBIK, executive vice-president and treasurer.







New officers of Motch & Merryweather Machinery Co. are, from left to right, chairman of the board and secretary, George E. Merryweather; president, Charles B. Lansing; vice-president and treasurer, Clare R. Kubik.



carbide EUS

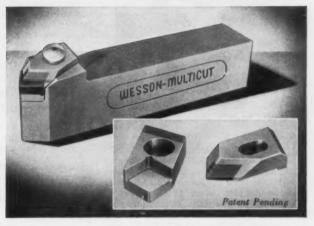
New "No Grind" Tools Cut Costs

Throwaway inserts and fully adjustable carbide faced chip-breakers among features of new Multicut line.

An entirely new series of Multicut tool holders for medium duty machining eliminates the need for all carbide grinding. Featuring a built-in carbide-tipped chip breaker with a wide range of adjustments, for different machining operations, the new Wesson Company holders do away with another area of maintenance costs—the grinding of chip breakers.

Large front and side clearance angles are made possible by the new holders, permitting ready application on jobs not possible previously with mechanicallyheld, carbide insert holders.

Another feature of the new Multicut is the one-piece anvil-locater plate, with built-in relief to clear built-up edges. Extreme strength and hardness overcome "feather edge" problems, especially on the end cutting edge angles.



New Multicut for medium duty machining. Inset shows anvil and adjustable chip breaker-clamp.

Chip breaker requirements of a wide range of machining operations are met by the adjustable breaker-clamp, available as either carbide-tipped for steel turning or steel-faced for cast iron. Serrations on the breaker-clamp matching those on the heel of the anvil-locater provide a wide range of settings beginning .050" back of the cutting edge.

Is Carbide Grinding on Way Out?

We doubt it, but the vast increase in life of carbide inserts achieved in Wessonmetal carbides has made it uneconomical to regrind tips or inserts, in many applications. It has become far cheaper, in many cases, to throw away the inserts when all cutting edges have been dulled.

Facts on comparative costs on specific applications are available from Wesson Company direct or its staff of field engineers.

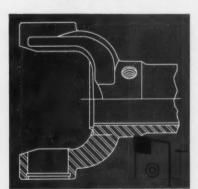
Shift to Wessonmetal Doubles Tool Life on Interrupted Cut

Production of automotive sleeve yokes on a job requiring a partially interrupted cut jumped from 137 to 300 pieces per grind at the plant of a midwestern manufacturer when a switch was made to Wessonmetal Grade WH and Wesson BDR band-type Multicuts from the steel cutting carbide formerly used.

The job is being done on a Lodge & Shipley 2-A Duomatic at 632 rpm and 372 sfm with a 3/32" depth of cut and .018" feed.

Workpiece is a fine-grain SAE 1140 steel forging. The area being cut on the sleeve is partially interrupted by the lubrication fitting hole. Wessonmetal Grade WH overcame the resulting excessive chipping of the carbides formerly used.

Wessonmetal doubles tool life on interrupted cut machining of fine grain SAE 1140 steel forging.







David A. Wallace, sales manager of Cincinnati Lathe and Tool Co.

DAVID A. WALLACE was appointed sales manager of the Cincinnati Lathe and Tool Co., Cincinnati, Ohio. Mr. Wallace has been associated with the company since 1949, most recently as assistant sales manager with headquarters in Cincinnati.

WILLIAM J. RYAN has been appointed assistant to the executive vice-president and general manager of the Clevland Crane & Engineering Co., Wickliffe, Ohio. Mr. Ryan, who has been with the company since 1949, was formerly personnel manager and office manager.

CLEVELAND CRANE & ENGINEER-ING Co., Wickliffe, Ohio, has begun construction of a shipping and receiving building which will be equipped with the latest handling facilities to expedite incoming materials and outgoing heavy machinery.

K-G EQUIPMENT Co., INC., Allentown, Pa., announces the appointment of Welders Service & Sales Co., 2164 Spring Grove Ave., Cincinnati, Ohio, as its distributor to handle K-G welding and cutting torches, regulators, and related equipment.

BAKER BROTHERS, INC., Toledo, Ohio has acquired certain assets of the Hall Automotive Equipment Line of the Waterbury Tool Division of VICKERS, INCOPORATED. Production of Hall valve seat grinding machines and allied equipment has been transferred from Waterbury, Conn. to Toledo where it will be carried on under the name Hall-Toledo. G. U. C. BAKER has been named vice president in charge of HALL-TOLEDO, and MILO C. GRAY general manager.

NORMAN W. OBERLE has been named merchandising manager of Baker Brothers, Inc., Toledo, Ohio. JOHN HOENIG has been appointed manager of the die cushion and plastic press department.

JAMES B. FLATTER has been elected secretary and treasurer of Baker Brothers, Inc., Toledo, Ohio. Lewis Pascoe has been named assistant to the president.

Pennsylvania

ROCKWELL MFG. Co., of Pittsburgh, Pa., has announced the following promotions: NORMAN W. ROWAND, former general manager of the Pittsburgh Division, has been named assistant to the vice-president; PAUL A. MANKIN, former chief engineer of the local division has been named general manager; ARTHUR W. KRAUSE, who was assistant general manager, has been named factory manager.

STANDARD PRESSED STEEL Co., Jenkintown, Pa., has opened its recently completed plating plant to precision job plating from outside firms. The plant was built primarily to electroplate and surface SPS products, but with excess capacity engineered into its nine separate plating lines SPS decided to include some outside work—but only the precision, close-tolerance work for which it is geared.

FRANK R. BENEDICT has been appointed manufacturing engineering manager of the Sturtevant division by the Westinghouse Electric Corporation, Pittsburgh, Pa. He will supervise the operating methods, tooling and processes of manufacturing, as well as coordinate the functions of engineering for the division. Mr. Benedict has been with the company for twenty-seven years.

George Bennethum has been appointed assistant manager of tool steel sales for the Carpenter Steel Co., Reading, Pa. He formerly served as a sales representative in Cleveland, and has been with the firm since 1940. Martin J. Holleran has been appointed branch manager of the company's North Jersey sales territory.

James L. Duchene has been appointed as sales engineer by the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. He will be located in the Pittsburgh office, 567 Union Trust Building. Mr. Duchene's territory includes Western Pennsylvania, Northern West Virginia and Southern Ohio.

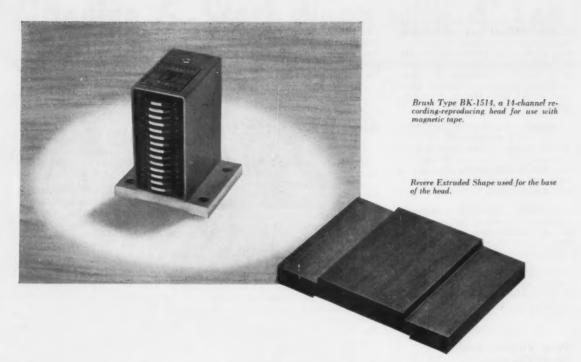
ROBERT NEILSON has been appointed engineering specialist of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. He will serve as consultant on problems involving capacity and tool selection for hydraulic press applications.







(Left to right) Norman W. Rowand, assistant to the vice-president of the Pittsburgh Division of the Rockwell Mfg. Co; Paul A. Mankin, general manager; Arthur W. Krause, factory manager.



Revere Extruded Shape

Saves 15¢
per piece
For Brush

The base of the magnetic recording-reproducing head shown here is a Revere brass extruded shape. You can see that it is rather simple in design, yet Brush Electronics Co., Cleveland, Ohio, reports that the shape saves 15¢ per piece (1½" long) over the previous method of milling the piece out of solid bar. There were three operations required on the bar, which weighed 1.61 lb. per foot, against 1.22 lb. per foot for the shape. Eliminating the machining operations, and reducing scrap almost to the vanishing point, produced the economy.

The head in question can record and reproduce signals from 14 channels, at frequencies within, below, or above the audible range. Such a head is being increasingly employed to handle information to be used for computation, telemetering, inventory records, process control (automation) and similar purposes.

Extruded shapes by Revere should be looked into if you are doing any extensive machining of raw stock in copper and its alloys, and aluminum alloys. The extrusion process is much like squeezing paste from a tube. Much more intricate shapes than the one shown here are possible. Naturally, all design lines must be parallel to the axis of extrusion. Get in touch with the nearest Revere Sales Office, and see if Revere Extruded Shapes may not save you money.



COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801 230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere. ALBERT C. REDDING has been appointed technical and development engineer by the Crucible Steel Company of America, Pittsburgh, Pa. He will be attached to the central operating staff in Pittsburgh. Mr. Redding was formerly production manager of the Kidd Drawn Steel Co., Aliquippa, Pa.

FREDERIC L. MOFFET has been named chief metallurgist of Park Works Division of the Crucible Steel Company of America, Pittsburgh, Pa. Mr. Moffet joined Crucible in 1934 and was most recently a contact metallurgist.

RICHARD A. BIGGS has been named manager of product development of the stainless division of the Crucible Steel Company of America, Pittsburgh, Pa.

ROBERT O. FRICK has been appointed advertising manager for the Philadelphia Gear Works, Inc., Philadelphia, Pa.

West Virginia and North Carolina

DEWEY O. OLSON has been appointed mill works manager of the Follansbee plant at Follansbee, W. Va. He has been active in steel mill management for over thirty years.

SOUTHERN SCREW Co., Statesville, N. C., is beginning production of its new plant there. The building is the first unit in a \$2,000,000 expansion program which will almost double the company's present space.

Coming Events

MARCH 14-18—First Western Industrial Exposition sponsored by the AMERICAN SOCIETY OF TOOL ENGINEERS to be held at the Los Angeles, Calif., Shrine Auditorium and Shrine Exposition Hall. The exposition will run concurrently with the A.S.T.E. meeting. Executive Secretary, Harry E. Conrad, 10700 Puritan Ave., Detroit 21, Mich.

MARCH 28-APRIL 1—Ninth Western Metal Exposition and Congress sponsored by the AMERICAN SOCIETY FOR METALS and nineteen other technical societies to be held at the Pan-Pacific Auditorium and the Ambassador Hotel, respectively, Los Angeles, Calif. A.S.M. secretary, William H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

APRIL 13-15—Tenth annual Meeting and Lubrication Exhibit of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Hotel Sherman, Chicago, Ill. Administrative secre-

tary, William P. Youngclaus, Jr., 84 E. Randolph St., Chicago 1, Ill.

MAY 16-20—SIXTH NATIONAL MATERIALS HANDLING EXPOSITION at International Amphitheatre, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 31-JUNE 3—THIRD BASIC MATERIALS EXPOSITION to be held at Convention Hall, Philadelphia, Pa. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17—METALWORKING MACHINERY AND EQUIPMENT EXPOSITION to be held at the Coliseum, Chicago, Ill. Further information can be obtained from Fuller & Smith & Ross, Inc., 105 W. Adams St., Chicago 3, Ill.

SEPTEMBER 6-17—Machine Tool Show sponsored by the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION to be held at the International Amphitheatre, Chicago, Ill. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17—PRODUCTION ENGINEERING SHOW, coinciding with the Machinery Tool Show, to be held at the Navy Pier, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.



Compressed air powers this shear at the Cubic Corporation, San Diego, Calif. A 4-inch diameter air cylinder that has a 10-inch stroke acts against the ends of two levers connected to the shearing blade. Plant line pressure of 100 pounds per square inch produces a total force of 4800 pounds on the blade. A two-way exhaust valve incorporated in the foot-pedal unit provides instant pressure release when the operator's foot is raised.

Grinding 5-Start Worm with 4" Lead

EX-CELL-O THREAD



In the photograph at the left the operator is grinding a worm shaft for use in a special machine. The part is about 22" long and the worm is 41/2" long, 3.430" O.D., has 5 starts, a pitch of .800", a lead of 4" and a tooth depth of .5454". The worm was ground in two operations on a standard Style 36 Thread Grinder. It was rough ground from the solid, hardened, then finish ground.

For complete information and specifications on the Style 36 and other Ex-Cell-O Thread Grinders contact your local representative or write today to Ex-Cell-O.



A COMPLETE LINE OF PRECISION THREAD GRINDERS



STYLE 50 Precision Thread Grinder a versatile machine for exal work, also available with internal attachment.

STYLE 33

for external work.

STYLE 39-A

Precision Thread Grinder-a high production machine for internal threads.

STYLE 36

Precision Thread Grinde versatile machine for extra long external threads available with internal attachment.

EX-CELL-O corporation • Detroit 32, Michigan

New Books and Publications

VIBRATION PROBLEMS IN ENGINEER-ING. By S. Timoshenko. 468 pages, 6 by 9 inches. Published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York City. Price \$8.75.

In this third edition, written in collaboration with D. H. Young, the analysis of vibration problems is greatly expanded with many new methods investigated, particularly in the field of non-linear vibrations. A number of solved examples have been added, and the use of the Lagrangian equations dropped in favor of the more familiar d'Alemberts' principle. The Appendix dealing with vibration measuring instruments has been omitted.

Chapter headings are as follows: Systems with One Degree of Freedom; Systems with Non-Linear and Variable Spring Characteristics; Systems with Two Degrees of Freedom; Systems with Several Degrees of Freedom; Vibrations of Elastic Bodies; Author Index; Subject In-

The major purpose of the revision is to make the book more suitable for teaching purposes, and to include important developments in the field.

TAPS AND DIES FOR UNIFIED AND AMERICAN SCREW THREADS, 14 pages, 8 1/2 by 11 inches. Published by the Tap and Die Divi-

This publication contains major revisions in tap standards effective February 1, 1955, and supersedes the 1952 edition. The changes, which effect nomenclature as well as pitch diameter limits in certain ranges. are carefully explained.

The new edition contains the same outstanding features of the original, although many new developments have been included. It will aid those using the information in their daily

TENTATIVE SPECIFICATIONS NICKEL AND NICKEL-BASE ALLOY COVERED WELDING ELECTRODES. 12 pages, 6 by 9 inches. Issued jointly by American Welding Society, 33 W. 39th St., New York 18, N. Y., and American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price (paper-bound), 25

sion, Metal Cutting Tool Institute, 405 Lexington Ave., New York 17, N. Y. Price, 50 cents.

sile strength alloy of tungsten, nickel, and copper, can be readily machined and ground, according to engineers of the Carboloy Department of the General Electric Co., Detroit, Mich. Hevimet is used extensively as a weight and for radioactive shielding. It is approximately 1.5 times as heavy as lead. Its machining characteristics are similar to those of cast iron. Carbide tools for turning, boring, and facing Hevimet should be ground without back rake and have a side rake of 6 degrees. an end clearance of 7 degrees, a side

Machinability of Hevimet

Hevimet, a high-density, high-ten-

side cutting edge angle of 15 degrees. Carbide cutters for milling and shaping Hevimet should have an axial rake of 10 degrees, a negative radial rake of 10 degrees, a face relief of 7 degrees, a peripheral relief of 7 degrees, a face cutting edge angle of 6 degrees, and a peripheral cutting edge angle of 45 degrees.

clearance of 7 degrees, an end cut-

ting edge angle of 8 degrees, and a

In grinding the best results are obtained by using a medium hard aluminum oxide grit with medium grain and spacing and a vitrified

Michigan Tool Merges with Ex-Cell-O

Confirming a merger with the Ex-Cell-O Corporation, Detroit, Mich., Marvin R. Anderson, executive vice president of the Michigan Tool Co., emphasized that an exchange of stock between the two concerns involves no basic changes for either Michigan Tool or its Canadian subsidiary, Colonial Tool Co., Ltd. Although these companies will be wholly-owned subsidiaries of Ex-Cell-O, they will be operated independently under the same management as before. Oscar L. Bard, president of the Michigan Tool Co., became a director of the Ex-Cell-O Corporation.

Worn Steel Parts Replaced with Tungsten Carbide

By replacing a number of critical steel parts on band-saw setting machines with tungsten-carbide parts and inserts, the Henry G. Thompson & Son Co., New Haven, Conn., manufacturer of profile, band, and hacksaw blades, has reduced maintenance costs to a minimum and obtains uniform product quality. Some Kennametal parts have been in service for more than three years and to date show a wear-life ratio of 60 to 1 over their steel counterparts. On this basis, a conservative estimate of total life of the Kennametal parts would be 200 to 1 over steel.

Reviews of Available Motion Pictures

JIG BORERS FOR PRECISION WORK

How precision is built into the manufacture of a modern jig borer and then is transferred to the product is revealed in a new film released by Pratt & Whitney, Division of the Niles-Bement-Pond Co., West Hartford, Conn. The film, entitled "Accent on Accuracy," discloses how the company's background in the field of precise measurement is fully utilized in the design of its lines of Electrolimit and end-measure jig borers. The 16-millimeter sound-color film has a running time of twenty-eight minutes. It is available on a free-loan basis to technical societies, plant groups encompassing management and supervisory personnel, and interested educational groups. Requests for reservations should be made by society or company officials.

PRECISION METAL FORMING

A colored motion picture that traces the development of the radial draw former, a machine which combines the principles of rotary stretch and rotary compression forming, is being made available to all groups interested in metal form-

ing by the Cyril Bath Co., Solon, Ohio. The film shows how the latest machine, equipped with the traversing compression unit which "irons" the part being formed against the die, is used to produce rings, arcs, parts with long sweeping curves, and angle-changing and multi-plane parts from stainless stels, hightensile aluminum, and other metals. The formation of joggles, reverse bends, and large sheet parts is also demonstrated. The film is concluded with a glimpse of giant metal-forming machines which will find a place in the aircraft industry in the near future.

HELIWELDING PROCESS

A color and sound motion picture recently produced by the Air Reduction Sales Co., New York City, deals with the tungsten inert-gas arcwelding process. This process, known as "Heliweld," was specifically developed for rapid joining of light gages of the so-called "hard-to-weld" metals and alloys, such as nickel, stainless steel, aluminum, brass, copper, titanium, beryllium alloys, cast iron, Everdur, Inconel, Monel, and silver. The motion picture lasts for twenty minutes.



What makes a "Red End" Blade cut better, last longer on the average than other blades? The answer's in the picture. Every "Red End" tooth takes exactly the same bite, curls the chip like a cutting tool on a lathe.

Because every tooth in every "Red End" Blade is exactly the same. It's all in the way we pour and roll our own steel... the way we mill the teeth to exact size and shape... set them evenly and accurately... and the special way we heat-treat them to a uniform hardness never believed possible before.

The result is faster, straighter cutting, and many more cuts per blade. If you haven't tried them yet—your local Industrial supply Distributor stocks 'em. Get some today and see.



There's a RED END Blade For Every Job



HIGH SPEED MOLYBDENUM — the RED Blade for cutting mild alloy steels and general purpose use.



HIGH SPEED TUNGSTEN — the GREY Blade for cutting hard alloys and stainless steels.



HIGH SPEED WELD-EDGE — the SHATTERPROOF Blode for use where maximum safety is required.

Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon • Canadian Factory in Montreal, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, N.Y. Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada









(Left to right) William G. Baldenhofer, president and general manager; Ralph Baldenhofer, vice-president and treasurer; John C. Wilson, vice-president in charge of sales and engineering; and Mrs. Ruth Andrews, secretary.

Thompson Grinder Celebrates Fiftieth Anniversary

The Thompson Grinder Co., one of the world's largest manufacturers of machine tools in its field, is celebrating its Fiftieth Anniversary. The company was founded in Springfield, Ohio, in 1905. Early Thompson developments included in-position wheel-truing; hydraulic rapid traverse; highpowered wheel-heads; automatic broach sharpening; wide crossfeeds; push-button wheel-truing; electric angular wheel-truing: precision anti-friction elevating screw: centralized control; silver bearing spindles; and pressure lubrication.

Crush-grinding also became a

famous patented Thompson grinding method. Thompson Truforming was announced in the Fall of 1943. An area of 23,000 square feet of floor space was used by the company in the thirties, but it expanded so rapidly that by the mid-forties 75,000 square feet of space was needed. An average of three hundred workers are now responsible for production. Controlled coolant through the wheel was developed by Thompson in 1946. Then followed developments such as the Hydrail grinder, making possible grinding of highly accurate and fine finishes of large machine tools. A line of vertical

spindle grinders with sliding column known as Hydrovert grinders, for grinding multi-level or wide flat surfaces, and dual rotary grinders for high production of such parts as automatic transmission gears and circular saws.

Christian Baldenhofer, founder of the company, passed away in 1953. Today the company is under the capable leadership of William G. Baldenhofer, president and general manager; Ralph Baldenhofer, vice-president and treasurer; John C. Wilson, vice-president in charge of sales and engineering; Mrs. Ruth Andrews, secretary; and F. T. Wilson, assistant secretary.

Awards for Arc-Welded Machine Tool Designs

Dr. E. E. Dreese, chairman of the Board of Trustees of the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, has announced the sponsorship by the Foundation of a \$12,000 Machine Tool Design Award Program. Awards will be made for papers describing the use of arc welding in machine tool design.

The program is open to all persons who are or have been engaged in the design or making of metal cutting or metal forming machine tools. A total of 15 awards will be made with a top award of \$3,000; other main awards of \$2,500, \$2,000, \$1,500 and \$1,000; and 10 awards of \$200 each. Awards will

be made to the 15 best papers submitted to the Foundation describing the use of arc welding in the design of either a component part or complete machine tool.

The tool may be either a metal cutting or metal forming tool as defined by the National Machine Tool Builders' Association. The work or equipment described must have been planned or executed in the period from January 1, 1953 to July 15, 1955, and the design may be one that either has been manufactured or one that is planned to be manufactured. Also, it may be either a redesign or a new design. The program closes July 15, 1955.

The award program is open to all persons in the United States and its possessions who have actually been engaged in the design or manufacture of the equipment described. A single author or a group of authors may submit a paper. A booklet describing the program and how to participate is available from the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.

Monel tubes up to 85 feet in length can be drawn at the new cold-draw section of the International Nickel Co., Inc., at its Huntington, W. Va., Works.

the De Laval Separator Company ..

OF POUGHKEEPSIE, NEW YORK

over O years

emphasizes TWO IMPORTANT POINTS

about their several

SIDNEY LATHES

"It has an extremely solid construction which gives a good finish so that very little polishing is necessary."

"It has been accepted by our operator and personnel within the department as a machine of clean, rugged design."

SIDNEY LATHES

PROVE THEIR
SUPERB PERFORMANCE

IN YOUR PLANT

MORE WORK PER HOUR ..

LOWER COST PER HOUR THE DELAVAL SEPARATOR COMPANY USES

SIDNEY FLUID TRACER LATHES

to make form punches and dies with the satisfactory results mentioned in their comments. All Sidney Lathes are designed throughout to provide unusual strength which insures long life and years of satisfactory performance.

Write for Bulletins

THE SIDNEY MACHINE TOOL CO. . SIDNEY, OHIO

Builders of Precision Machinery since 1904



if 4½ percent interest is "gilt-edge"

To many investors, a conservative security that consistently yields $4\frac{1}{2}\%$ is considered "gilt-edge." But here is an investment that consistently yields 50% or more a year—with no risk to you.

To drill oil holes in this crankshaft with standard equipment and obtain 46 cranks/hr. would take many machines and operators.

With the Avey machine and one operator, unit costs drop so far that the machine is paid for in less than 18 months.

The 14-station machine has Line-O-Dex indexing, automatic hydraulic clamping and positioning, and drills ½" holes with Aveydraulic Torquematic deep hole drilling units.

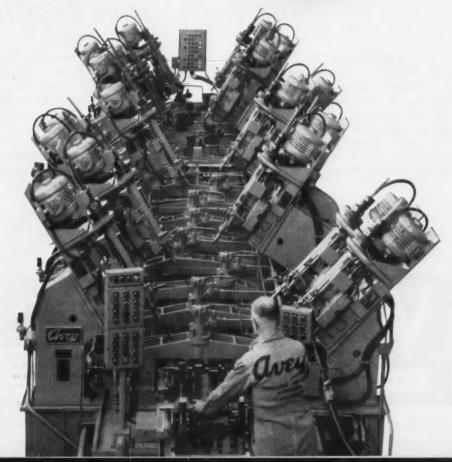
When this order is complete, or the part changes in design, the Avey standard units can be rearranged for a new job an economical way to extend the life of your investment.

Avey's pay-as-you-produce plan helps you make this fast-earning investment now. Whether your part is a crankshaft or a door check—ask Avey for a profit prediction.

THE AVEY DRILLING MACHINE CO., CINCINNATI I, OHIO drilling, tapping, production machines

... what's 50 percent?





PLAIN PLUG GAGES ** class XXX!!



Now available for fine inspection requirements

In response to persistent demand, VK has developed and now announces a new, ultra-fine, plain plug gage tolerance of .00001", designated as Class XXX. This new tolerance, half of that of Class XXX, satisfies a need, long evident, for gages to meet part limits finer than .0002", and permitting only ten millionths of an inch total variation on the gage in sizes up to .825" diameter, and only fifteen millionths in sizes from .825" to 1.510" diameter. Tolerance may be applied either bilaterally or unilaterally.

Inasmuch as Class XXX tolerance must take into account such factors as

finer diameter variation, a high order of roundness control, an exceptional surface finish and an extreme resistance to wear (all of which offset the shallow wear depth inherent in such a gage class), Class XXX is offered in only Chromium Plated and Carbide Gages.

VK Class XXX Plain Plug Gages are furnished in the materials, styles and ranges shown in boxed panel above. VK also furnishes Class XX, X, Y, and Z standard tolerance plug gages in wire type, taper lock and trilock designs. For complete information address: The Van Keuren Company, 178 Waitham St., Watertown, Mass.

"Quality in Millionths"



THE Van Keuren co.,

178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment © Light Wave Micrometers © Gage Blocks © Taper Insert Plug Gages © Wire Type Plug Gages © Measuring Wires © Thread Measuring Wires © Gear Measuring System © Shop Triangles © Carboley Cemented Carbide Bug Gages © Carboley Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages



MAKE GAGES LAST LONGER!



- X Don't force a gage into or over the part being checked.
- X Don't lay gages on metal benches, machines or dirty surfaces.
- X Don't clean gages in water, soluble solutions, kerosene or carbon tetrachloride—all cause rusting.
- X Don't spin parts on or off gages. This induces rapid wear.
- X Don't lay gages in the sunshine expansion will cause errors.
- X Don't use gages that fit loosely. Know the "feel" of proper gaging.
- X Don't use gages that show visible burrs, nicks or other irregularities, and REMEMBER - reversing the plugs, end for end, and careful removal of a small segment of the leading edge when it becomes worn will provide up to six times longer useful life!

We'd like to discuss your gage needs and have your gage orders. Our engineering representatives are located in all principal cities. Write or telephone us today.

* Reprints of this ad printed on heavy coated stock are available at no charge for posting in your inspection department or laboratory.



- Learn how to properly hold and use your gages. Fit must be snug and smooth. Make wooden, felt covered gage racks. Oil the felt surface. This helps to keep your gages clean.
- Roll or twist the gages into the work slowly to get the proper feel.
- ✓ Check every gage against the master gages before using, at least once on every shift and before returning to the tool crib.
- Include gaging expense as part of manufacturing budget. Quality product companies now do this.
- ... AND insist on all of these quality features when you buy new gages:
- Reversible Plugs... enable you to cut off worn tips at each enduse new section exposed for six to eight times more wear life.
- Entire Plug Surface Usable-straight untapered pieces provide uniform gaging surface over entire length—finish to 1.5 microinches RMS or less for maximum amount of wear life.
- Pin-Vise Aluminum Handle positive locking; plugs can't slip. Easily loosened for replacing or reversing plug. Plug length adjustable for different hole depths.
- Easy Recognition-GO in green finish; NO GO red.
- Special Hardening-plugs hardened throughout...enables you to grind down to smaller size...gives greater economy.

of AMERICAN GAGE and MACHINE COMPANY Division

SIMPSON ELECTRIC COMPANY

5200 West Kinzie Street Chicago 44, Illinois ESterbrook 9-1121

Manufacturers of over 3,000 different panel meters and world's largest pro-ducer of TV test equipment.

SIZE CONTROL COMPANY

2500 West Washington Boulevard Chicago 12, Illinois MO nroe 6-6710

Creators of the Centerless Lapping Machine and originators of reversible thread gages.

WAISH PRESS & DIE COMPANY

4709 West Kinzie Street Chicago 44, Illinois ES tebrook 8-6700

Manufacturers of high speed quality punch presses since 1907.

PORTAGE

(4" Diameter Spindle)

Horizontal Boring, Drilling & Milling Machine Outstanding . . .

MACHINE OF THE YEAR
Unsurpassed in Price and Quality

AS LOW AS \$31,358 (COMPLETE)

*Pay as you depreciate plan

a real saving in new machine investment. PORTAGE mills cost from 5% to 20% LESS than present comparable makes . . . and the amazing part of this savings is the machine itself . . . Write today for literature covering all

* For full particulars, phone the factory today!

THE PORTAGE MACHINE CO.

the specifications and features on the PORTAGE Mill.

The PORTAGE Boring, Drilling & Milling Machine offers

1036 Sweitzer Avenue • Akron 11, Ohio Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916.

278-MACHINERY, March, 1955

Write for Catalog

today!

For more information on products advertised, use Inquiry Card, page 257

LEADING THE INDUSTRY IN DESIGN...



Exclusive with Etna is the cluster unit. This unit progressively rolls the tube into shape without excessive stretching of the edges, thereby eliminating the "buckling" experienced with ordinary tube mills. Etna machines are not forming mills, they are designed for one purpose only... to make clear, well formed carbon and stainless steel tubing with no marking, no scratching, no upset edges. Write for complete details.



The ETNA 4KU Mill

Abbey

ZZZ Company

3422 MAPLEWOOD AVE., TOLEDO 10, OHIO

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-279



In Plastics



In aluminum



In Cast Iron



In Wood



In Steel

NATCO
HIGH SPEED, SENSITIVE
MULTI-DRILLERS
and TAPPERS



H-5 and H-6
STANDARD AND HEAVY DUTY
MACHINES

(H-6 Machine Illustrated)

...REDUCE COSTS WITH INCREASED PRODUCTION OF SMALL PARTS!

The NATCO Model B-33 light, sensitive multi-drilling and tapping machine shown at right is available in three feed arrangements: hand and foot feed or combination hand and foot and air-oil feed; and air feed. These machines have adjustable spindle arrangement for different work setups and a large working table. They offer maximum production on light work where super-sensitive operations and high speed are important.

NATCO H-5 and H-6 high speed sensitive multi-drillers and tappers are furnished in standard and heavy-duty models with adjustable multispindle, fixed center spindle or slip spindle type heads. They are provided with change gears and quick change speed mechanism for correct spindle speeds. They will efficiently handle a wide range of small and medium-sized work and make possible multiple drilling or tapping of small holes at minimum cost.

B-33
LIGHT, SENSITIVE
MACHINE





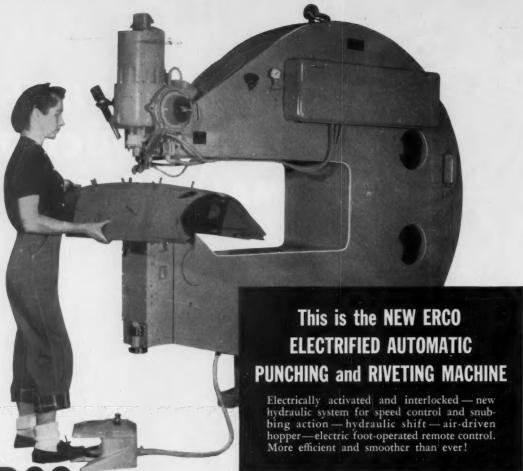
Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping (NATCO)

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

CHICAGO, Room 203, 6429 W. North Ave., Oak Park . DETROIT, 10138 W. McNichols Rd. BUFFALO, 1807 Elmwood Ave. . NEW YORK, 35 Beechwand Ave., Mauni Vernan



ERCO combines five operations in ONE



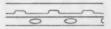
(1) ERCO rivets fit tight in the hole — with no burs or flashing between joints.



(2) ERCO precision Rivet Sets, Rivet Shoes, Strippers and Anvil Posts assure rivet heads concentric with rivet shank.



(3) All heads are uniform because the Anvil Post is adjusted for thickness of material, length of rivet, width and height of upset head.



(4) ERCO Countersunk Rivet Tooling is made for the exact degree of flush head rivet for which it is to be used.

- 1 Punching or Drilling and Reaming holes
- 2 Deburring holes
- 3 Press Countersinking holes for flush head
- 4 Hand Feeding rivets
- 5 Heading rivets

ERCO Automatic Riveters complete all five operations in one, with greater uniformity and strength, in a fraction of the time required for separate operations. What's more, ERCO eliminates many costly drilling jigs or fixtures for added substantial savings.

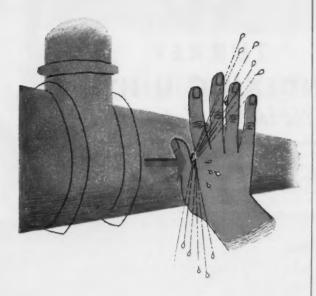
These machines handle *all types* of solid rivets at speeds up to 35 per minute, meeting the rigid precision standards of the aircraft industry . . . where earlier ERCO models have been in constant service for 15 years.

For complete information, send for illustrated catalog today!

ENGINEERING and **RESEARCH**

A DIVISION OF QC F INDUSTRIES

RIVERDALE, MARYLAND





a hole here means trouble... a hole here saves trouble

Crucible Hollow Tool Steel Bars are a great trouble-saver for the metalworking industry. For they eliminate costly, time-consuming drilling, boring, cutting-off or rough-facing operations. And you save production time, machine capacity, and avoid scrap losses . . . for the hole is already in the steel you buy.

Crucible Hollow Tool Steel Bars are now available in any of our famous tool steel grades . . . in almost any combination of O.D. and I.D. sizes. And you get immediate delivery of five popular grades - KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon highchromium, AIRKOOL air-hardening, and NU DIE V hot-work tool steels.

Let your Crucible representative show you how these easy-to-use Crucible Hollow Tool Steel Bars can save you time and money. Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.

Visit us at Booth 350 Western Metal Show



first name in special purpose steels

Company **America**

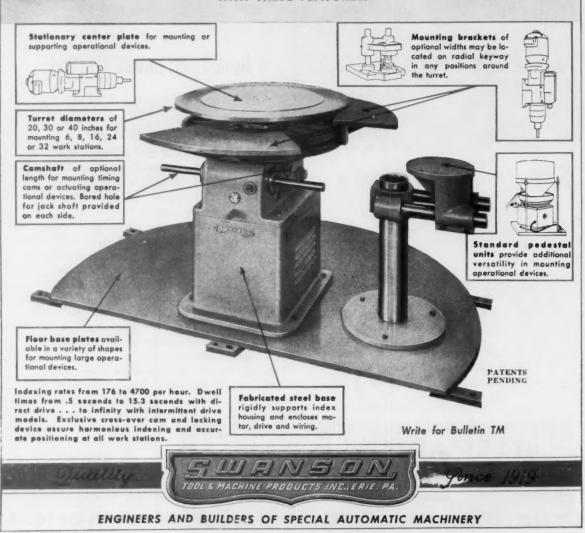
For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-283

TURRET INDEXING UNITS Lower the cost of Automation

These versatile, "packaged" units provide the basic chassis for a wide range of special automatic machines for precision machining, processing or assembling operations on small and medium parts. Because they eliminate much of the engineering and building time formerly required, Swanson units lower costs and shorten completion time . . . considerably broadening the practical applications for automation. Further, because of the simplicity with which standard or special operational devices can be grouped around the turret, a wide latitude of tooling arrangements is possible. Interchangeable turret assemblies and mounting brackets are available for complete tooling changeover.

ONLY SWANSON PROVIDES A STANDARD TURRET INDEXING CHASIS WITH THESE FEATURES:





Danly Die Set Service is Faster!



Choose the Danly Branch closest to you-

1807 Elmwood Avenue BUFFALO 7_ CHICAGO 50 2100 S. Laramie Avenue CLEVELAND 14 1550 East 33rd Street DAYTON 7 3196 Delphos Avenue DETROIT 16 1549 Temple Avenue GRAND RAPIDS 113 Michigan Street, N.W. INDIANAPOLIS 4 5 West 10th Street LONG ISLAND CITY 1 47-28 37th Street LOS ANGELES 54 Ducommun Metals & Supply Co.,

4890 South Alameda
MILWAUKEE 2 111 E. Wisconsin Avenue
PHILADELPHIA 40 511 W. Courtland Street
ROCHESTER 6 33 Rutter Street
ST. LOUIS 8 3740 Washington Blvd.
SYRACUSE 4 2005 West Genesee Street

One of the main reasons for Danly's faster die set service is the interchangeability of die set parts achieved by Danly. It starts at the main Danly Plant where die set components are produced to Danly's traditional high quality, precision standards. The faster service cycle continues at all of the Danly Branch Plants where thousands of interchangeable die set components are stocked. The cycle is completed at the Danly Branch in your area where these parts are assembled as a die set to meet your specific requirements and shipped as soon as your order is received. So remember—for the best in die sets in the shortest time, the place to call is your local Danly Branch.



DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue Chicago 50, Illinois



Sharp Clean Cuts EVERY TIME

Many thicknesses and sizes of metal are cut on this Steelweld Shear every day. Thanks to Steelweld's exclusive MICRO-SET knife adjustment, it is easy to set the knife clearance to the exact amount which will produce the best cut for every plate run through the machine.

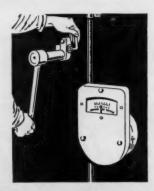
If desired, the knife clearance can be set for an average thickness and all plates cut without changing the clearance. This procedure is used with most shears because to change knife clearance on them is a tedious, difficult operation which usually puts a machine out of service for hours.

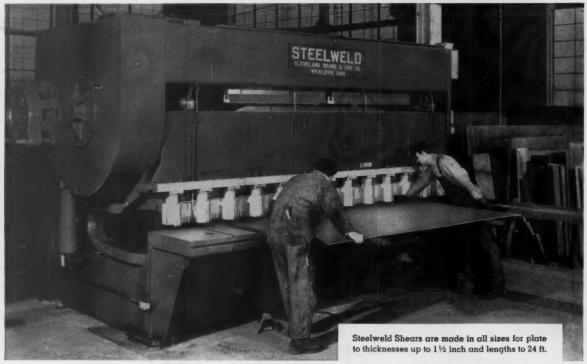
In contrast, knife adjustment on Steelwelds is made in a few seconds. It's simply a matter of turning a crank until an indicator points to the figure representing the thickness of plate being cut. No bolts to loosen; no parts to move. There is no need for using "average" knife settings.

The clutch and brake unit is another outstanding feature of Steelweld Shears. As it is air-operated, it is quick, snappy in action. Its low-inertia design assures cool operation, even after long continuous production runs, because energy to be dissipated is minimized and working pressure necessary on clutch and brake facings is greatly reduced.

The many features of Steelweld Shears make it worth your while to get all the facts.

Because of MICRO-SET Knife Adjustment







GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated. THE CLEVELAND CRANE & ENGINEERING CO.

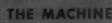
5446 East 282 St., Wickliffe, Ohio

STEELWELD PINOTED SHEARS

10 Station Automatic In-Line

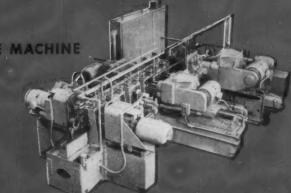


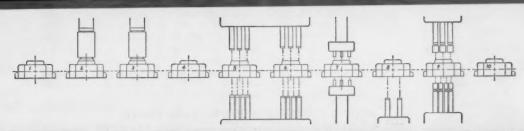
Performs Multiple Operations on Tractor Housings



THE PART







STATION NO. 1 LOAD 1 PART

STATION NO. 2

UNIT NO. 1 COMB. SEMI. FIN. BORE 5.165 & 3.249 & 2.861 DIAS. COMB. SEMI. FIN. BORE 4.425 THRU BOTH WALLS

STATION NO. 3

UNIT NO. 1 COMB. FIN. BORE 5.180 & 3.264 & 2.876 DIAS. COMB. FIN. BORE 4.440 THRU BOTH WALLS

STATION NO. 4

THE OPERATIONS

STATION NO. 5

UNIT NO. 2 "U" DRILL 5 HOLES 31/64 DRILL 6 HOLES

UNIT NO. 3 31/64 DRILL 8 HOLES 21/32 DRILL 1 HOLE "U" DRILL 6 HOLES 23/32 DRILL 1 HOLE

STATION NO. 6

UNIT NO. 2 1/2 CHAMFER 5 HOLES % CHAMFER 6 HOLES

% CHAMFER 7 HOLES 13/16 CHAMFER 1 HOLE ½ CHAMFER 6 HOLES 23/32 DRILL 1 HOLE COMB. COUNTERBORE UNIT NO. 3 796 & CHAMFER 1 HOLE

STATION NO. 7 INSPECTION

STATION NO. 8

UNIT NO. 4 .6910 REAM 1 HOLE .8157 COUNTERBORE 1 HOLE

STATION NO. 9

UNIT NO. 5 7/16-14 N.C. TAP 5 HOLES 9/16-12 N.C. TAP 6 HOLES

UNIT NO. 6 7/16-14 N.C. TAP 6 HOLES 9/16-12 N.C. TAP 7 HOLES ½-14 N.P.T. TAP 2 HOLES

STATION NO. 10 UNLOAD 1 PART

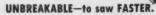
Whatever Your Specific lob Problem, Consult

NC., TOLEDO, OHIO

Features Essential to Top Hack Saw Blade Performance

ARMSTRONG BLUM MFG. CO.
CHICAGO ZZ MADE IN U.S.A.





Composite construction (a narrow high speed steel tooth edge electrically welded by the MAR-VEL-invented process to a tough, non-brittle alloy steel body), means that MARVEL high-speed-edge can be subjected to the MAXIMUM feed pressure that any hack sawing machine is capable of applying. MARVEL blades need not be "babied" for fear of breakage!



SHATTERPROOF-for SAFETY.

MARVEL blades never shatter or "explode" as do the ordinary "brittle" blades shown at left which so often cause personal-injury accidents such as the loss of an eye or severe laceration and expensive damage to the sawing machine. Operators who use MARVEL blades exclusively soon "get the habit" to apply heavier feeds, greater blade tension, higher speeds—to do their work faster, because they know they are SAFE with MARVEL.



SHARPER, PREMIUM-STEEL TEETH-to wear LONGER.

Teeth are accurately machined by a MARVEL-invented process that assures sharper tooth points and positive uniformity of tooth shape and degree of set from end-to-end of every MARVEL blade. The steel used in the tooth edge is carefully selected from the finest high speed steels available throughout the world, regardless of cost or source—truly premium steels, without premium cost.



QUALITY CONTROL-to assure UNIFORMITY.

With more than a quarter century of experience in inventing, perfecting, and producing welded-edge hack saw blades, MARVEL has provided its own laboratory with the most modern metallurgical instruments and techniques known to the applicable sciences for the specific purpose of maintaining highest possible quality control. Coupled with rigid tests and meticulous inspection of every MARVEL blade, uniform quality is assured.

These are only a few features that make MARVEL High-Speed-Edge Blades such outstanding performers

Ask for the latest MARVEL Cutting Tool Bulletin and the name of your closest MARVEL Distributor. Metal Cutting

Metal Cutting

Setter Machines-Better Blades

Metal Cutting

Setter Machines-Better Blades

Manufactured only by

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39 U S A.



IN THE AIRCRAFT INDUSTRY, IT'S

UNION



UNION DISTRIBUTORS SERVE THE NATION

FOR . SPEED

- · ECONOMY
- . RELIABILITY
- PERSONAL CONTACT

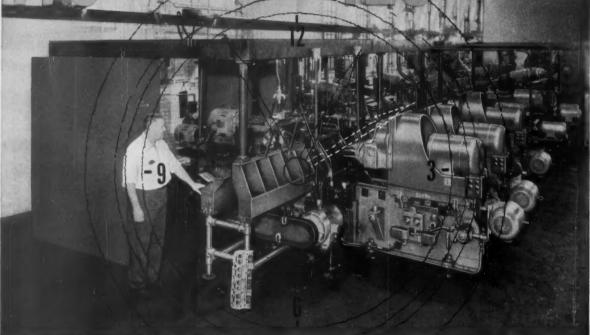
CALL YOUR UNION DISTRIBUTOR

UNION TWIST DRILL COMPANY . ATHOL, MASSACHUSETTS

OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.

BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec

Machine Operations on Cylinder Heads



= 22,400 OPERATIONS PER HOUR

Functioning automatically in TIMED SEQUENCE, this BAUSH TRANSFER LINE is producing accurately machined parts at low cost for a leading automotive manufacturer's new V-8 engine.



This 21 Station Baush Transfer Line consists of:

- 1 Loading; 13 Working; 2 Roll-over; and 5 Idle Stations having
- 12 Vertical Angular Model "S" Mechanical Leadscrew Units -
- 4 Horizontal Model "S" Mechanical Leadscrew Units -
- 1 Vertical Model "S" Mechanical Leadscrew Unit -
- 4 Horizontal 30F-18 Hydraulic Units -
- Vertical Hydraulic Unit mounted on hydraulic horizontal
- 2 Vertical Angle Hydraulic Checking Units -
- 22 Fixed Center Heads having a total of 175 spindles -
- 6 Transfer Power Units -
- 2 Roll-over Fixtures -
- 6 3-position Transfer Sections with Arch Fixture and Bushing Plates.

OPERATIONS:

Mill - Drill - Ream - Chamfer - Counterbore and Countersink — Spotface and Tap.

PRODUCTION:

Approximately 128 Cylinder Heads per hour at 100% efficiency.

For more information on products advertised, use Inquiry Card, page 257



अंदाक्ता ।

see it in action BOOTH 1077

Watch the versatile SIP Hydroptic-6 Jig Boring and Milling Machine in operation, demonstrating "a tenth at a glance" and a guaranteed Accuracy of 0.00015" for all settings of the work table and spindle head saddle.

- this Hydroptic and many other SIP High Precision Machines will be displayed at the Los Angeles A.S.T.E. Show, Shrine Auditorium March 14-18. We extend a cordial invitation to visit our Booth - to watch them in action!

AMERICAN SIP CORPORATION

100 End 42nd Street, New York 17, N. Y.



LAYOUT ... FOR PROFITS!



This is the ayout of a typical De Laval Cutting Oil Extraction and Purification System. Principal components are a De Laval Chip Oil Extractor and a De Laval Oil Purifier.

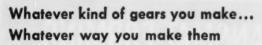
Similar De Lava Systems—custom-engineered to the specific requirements—save money in many leading metal fabrication plants... by more efficient reclamation of oil. Some have actually returned their entire cost in a single year!

De Laval Chip Oil Extractors and Oil Purifiers are made in many models and sizes. De Laval engineers are expert in their application. Write for full information . . . now.



DE LAVAL
purifiers and clarifiers
for factory oils

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 61 Beale St., San Francisco 5



can supply the right type cutting tool because we make all types

* National Tool Co., with 50 years experience in the manufacture of special cutting tools, makes all varieties of gear cutting tools for all types of spur, helical and worm gears—as well as for sprockets and splines. Whatever your gear requirements—large or small— National engineers can help you decide the most efficient method of producing them. Many gear manufacturers have found it profitable to look to National Tool Co. for all their gear cutting tool requirements.

ENILLIAN Good

Gear Shaving Cutters

Rack Type Gear Shaper Cutters

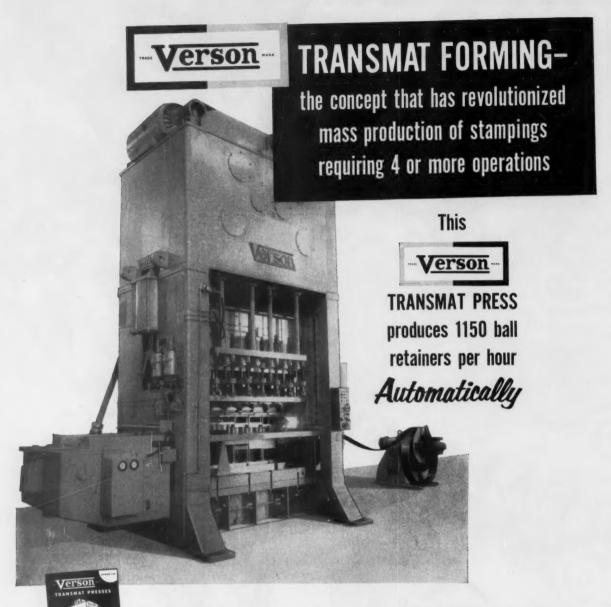
Involute Gear Cutters

Herringbone Gear Cutters

Gear Shaper Cutters

Cleveland 2, Ohio

Representatives in major industrial centers

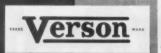


The 16 page Verson Transmat brochure describes typical machines and jobs. Write for your copy. • Since 1939, automation has been a reality for users of Verson Transmat Presses. With the Transmat Press four or more operations are performed automatically in a single press without intermediate handling, pickling or annealing. Feeding can be from coil stock or blanks. The piece is then transferred to each successive station by means of mechanical fingers synchronized with

the press action. Each station has its own separate and individually adjustable tooling. Each station has a separately adjustable slide.

If your daily requirements are 4,000 or more identical stampings involving four or more operations, it will pay you to investigate Verson Transmat Forming. For recommendations, send an outline of your requirements.

A Verson Press for every job from 60 tons up.



ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.
9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES . TRANSMAT PRESSES . TOOLING . DIE CUSHIONS . VERSON-WHEELON HYDRAULIC PRESSES

294-MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257



Now, Card brings you a precision line of gages along with renowned Card taps. You can specify and use both with complete confidence, knowing that whatever the job demands, you'll get top performance. We assure you that the new line of gages guarantees the same quality that has made Card taps famous over the past 81 years.

Contact your local Card Distributor for prompt deliveries and helpful service.

S.W. CARD MFG.CO



S. W. CARD MANUFACTURING CO.

MANSFIELD . MASSACHUSETTS

Division of Union Twist Drill Co. TAPS.DIES.SCREW PLATES.GAGES

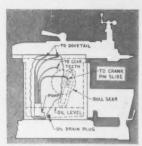
IMPROVED

SOUTH BEND 7" SHAPER

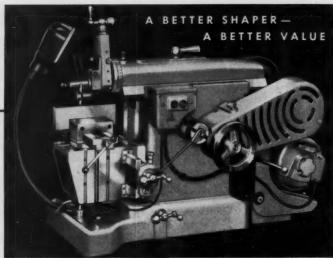
Compare These Value-Adding Features:

- Extreme precision for the most exacting tolerances.
- Convenient controls for easy handling.
- Ample bearing surfaces assure rigidity and durability.
- Powerful built-in V-belt motor drive.
- Smooth, quiet operation at all speeds.
- Quick acting belt tension release for changing speeds.
- Table sliding support shoe.
- Convenient length of stroke adjustment graduated 0 to 7".
- Reversible power cross-feeds .002" to .012".
- Graduated eccentric indicating power feed in thousandths.
- Swivel vise graduated in degrees mounts on top or side of table.
- Swivel tool head graduated in degrees, locks at any angle.
- Price \$551 f.o.b. factory, less motor. Time payment terms available.

ONLY 7" Shaper with Pressure Lubrication



Pressure lubrication of ram dovetail bearings, bull gear teeth and crank pin slide bearings keeps wear to a minimum, helps absorb shock of intermittent cuts. Flood lubrication of all other important bearings.















Compared with our costs OUR PRICES ARE LOWER than they were back in 1941 Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

	INFORMATION	CHECKE	D:	Tool	Z" BENCH
9" and 10" BENCH LATHES	FLOOR LATHES	PRESSES	TURRET LATHES	GRINDERS	SHAPERS
Name		St	reet		
CityStateSupplement					
ince 1906 · SOUTH BEND LATHE · South Bend 22, Indiana					

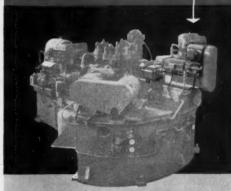
Building Better Tools S

Newmorris

AIR OIL MATIC DRILL UNITS

air power •
hydraulic control
or all-hydraulic
models

Unit Type Six-station automatic indexing machine for drilling, tapping and facing a master brake cylinder. The Air-Oil-Matic unit shown drills two .026" diameter holes at 10,000 R.P.M. in cast iron.



CONDENSED SPECIFICATIONS

Length, width, height Maximum HP at 1800 rpm

Spindle speeds

App. maximum thrust
Maximum drill size
Maximum stroke
Maximum feed stroke
Feed rate range
Quick approach rate

Quick return rate

33¼" x 11" x 23" 2 HP

133-6900 (Standard) (Special speeds on request)

650 lb. %" 6" 4½" 0 to 48"/min.

480"/min.

300"/min.

perfected to give exceptional versatility for higher production at lowest cost

Here's the automatic drilling unit you've been looking for! The Morris AIR-OIL-MATIC Drill Unit is a powerful package of precise versatility developed and perfected by one of the nation's leading manufacturers of high production drilling machinery. Now, this compact unit (air or oil powered and hydraulically controlled) is available for your use in special purpose machines.

Designed for a wide range of drilling, reaming, chamfering, spot facing, hollow milling, centering and related operations, it can be mounted in vertical, angular or horizontal positions. The Morris AIR-OIL-MATIC Drill Unit has adjustable feed rate, feed stroke, total stroke. Controls and actuating devices can be set to provide almost any desired sequence of operations. (see condensed specifications)

If you have mass production operations involving drilling or related operations . . . you'll want to know all about the Morris AIR-OIL-MATIC Drill Unit. New literature describing the unit, its advantages and applications and complete with specifications, is available on request.

Morris

MACHINE TOOL COMPANY

946 HARRIET ST., CINCINNATI 3, OHIO

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt Carborundum Co., Buffalo Ave., Niagara Falls, N. Y. N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn
22, N. Y.

ABRASIVES

See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford,
III.

ABRASIVES, Polishing, Tumbling, Etc.

Carborundum Co., Buffalo Ave., Niagara Falls,

Norton Co., 1 New Bond St., Worcester 6,

Mass. Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic

American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

Baldwin-Lima-Hamilton Corp., Eddystone Dv.,

Baldwin-Lima-Hamilton Corp., Eddystone Dv., Phladelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St. Ansonia, Conn.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rock ford, III.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Parter Co., Inc., Roselle, N. J.

AIR HOISTS-See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Bethlehem Steel Co., Bethlehem, Pa. Carpenter Steel Co., Reading, Pa. Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp.
Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge,
Mass.

ALLOY STEELS, High Temperature

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Non-Ferrous

American Brass Co., 25 Broadway, New York. Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y. Mueller Brass Co., Port Huron 35, Mich. Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc

New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES

See Presses, Arbor

ARBORS AND MANDRELS

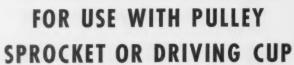
ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chcago, III.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinanti, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd
Ave., Chicago, 50, III.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St.,
Racine, Wis.
Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester,
Mich.

National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

(Continued on page 309)

ROCKBOR





COMPACT DESIGN # *This small diameter, heavy Handy Bulletin POWERFUL PULL duty ROCKFORD Toggle-

type, Over-Center CLUTCH SMOOTH ENGAGEMENT

UNIFORM PRESSURE

ACCURATE BALANCE LONG SERVICE LIFE

with gasoline engines or motors, in applications within its torque rating.

Shows typical installations of ROCKFORD ROCKFORD CLUTCHES fits readily into product de-

signs. Is well suited for use OFFS. Contains diagrams of unique applications.

Furnishes ca-pacity tables, dimensions and complete speci-







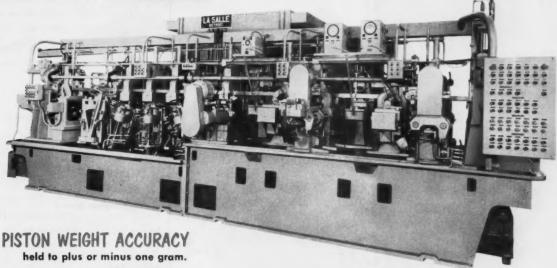




GOOOGB

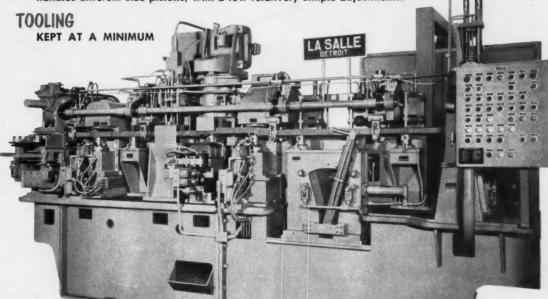
LA SAME AUTOMATED PISTON LINE

PRODUCES 400 PISTONS PER HOUR



MACHINE IS ADJUSTABLE

handles different size pistons, with a few relatively simple adjustments.



Written requests for information Honored Promptly. Patents Applied for.

re information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-299



The outstanding advantage of this machine is ability to handle operations on the two or three ends of a prod simultaneously or in seque e, without changing set-up or rehandling. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining ee ends simultaneously or in operations on one, two or sequence—a method exclusive with Goss & DeLeeuw and offered on this

EL CALLIBRARE. Cour. OLE-THO-THREE









For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.

GOSS and DE LEEUW



BABBITT

Bunting Brass & Bronze Co., Spencer and Carl-ton Aves., Toledo, Ohio. Johnson Bronze Co., New Castle, Pa. Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, III.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholf Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wishorris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St. Nam. Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.

BALL BEARING TESTERS

Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carl-ton Aves., Toledo, Ohio. Johnson Bronze Co., New Castle, Pa.

BARS, Steel

BARS, Steel

Allegheny Ludium Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Carpenter Steel Co. of America, Oliver Bidg.,
Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.
Timken Roller Bearing Co., Canton, Ohlo.
U. S. Steel Corp. (American Steel & Wire Co.
Div., Carnegie-Illinois Steel Corp. Div.,
Columbia Steel Co., Div., Tennessee Coal,
Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge,
Mass.

BASES, Machinery Welded Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carl-ton Ave., Toledo, Ohio. Johnson Bronze Co., New Castle, Pa.

BEARINGS, Ball

BEAKINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North
Quincy, Mass.
Farini Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg.,
Jamestown, N. Y.,
New Departure Div., General Motors, Bristol,
Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia,
Pa.
Norma-Hoffman Bearings Corp., Stamford,
Conn.

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer & Carl-ton Aves., Toledo, Ohio. Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y. Johnson Bronze Co., New Castle, Pa. (Continued on page 302)





doesn't go very



YOU NEED

- Onsrud high spindle speeds
- Onsrud fast fluid-feeds

TO REALIZE

- Finer surface finish
- Flat surfaces
- Higher production



FOR MODERN HIGH SPEED NON-FERROUS MILLING



Typical low cost set-up for manual profile milling operation using table guide-pin.

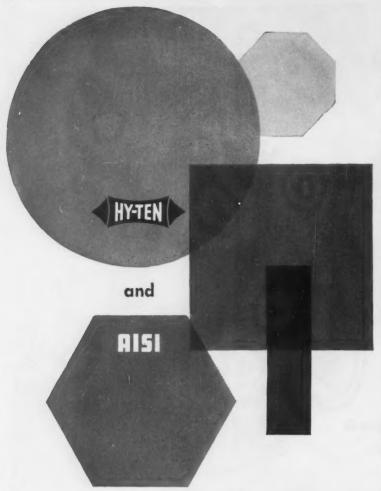
Here are some of the Onsrud design-features that result in better, faster production: High speed, high power Cutter Motor . . . direct drive, air cooled, two speed 3,600/7,200 RPM, $7\frac{1}{2}/15$ HP . . provides recommended speed of 7,000 to 10,000 surface feet per minute for milling aluminum and related metals. Longitudinal and Transverse Fluid-Feeds with Onsrud-design, synchronized lever control at speeds from 0" to 150" per minute. Vertical Table Feed up to 10", in speed range from 0" to 50" per minute under power Fluid-Feed. Onsrud method of milling makes use of smaller diameter cutters, high rotational speed, and milling off of very small chips . . to give extreme smooth finish. Table size $14\text{"x}\,56\text{"}$. . . flaps available for extra width.

Onsrud machines in your plant will save you hundreds or thousands of dollars per day . . . depending upon the amount of your production. For information about America's most challenging new production milling machine for nonferrous metals . . . write for the Onsrud A-245 Bulletin.

ONSRUD MACHINE WORKS, INC.

3940 Palmer Street

Chicago 47, Illinois



bars, billets and forgings in sizes, shapes and treatments for every need!

Wheelock, Lovejoy & Company, Inc., can fill your alloy steel requirements promptly. This applies to both standard AISI and SAE steels and to our own HY-TEN steels-"the standard steels of tomorrow". Take advantage of our seven strategically located warehouses. All of them can supply these steels in the form and quantity you need. Every warehouse, too, is staffed with expert metallurgists who are ready to serve you.

Write today for your FREE copies of Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

near you . . .

Warehouse Service—Cambridge • Cleveland • Chicago Hillside, N. J. • Detroit • Buffalo • Cincinnati In Canada-Sanderson-Newbould, Ltd., Montreal and Toronto



WHEELOCK, LOVEJOY & COMPANY, INC.

138 Sidney Street, Cambridge 39, Mass.

BEARINGS, Lineshoft

Fafnir Bearing Co., New Britain, Conn. Orange Roller Bearing Co., Inc., Orange, N. J. Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle

Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Roller

Ball & Roller Bearing Co., Danbury, Conn. Fafnir Bearing Co., New Britain, Conn. Hyatt Bearings Div., Harrison, N. J. Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y. Norma-Hoffman Bearings Corp., Stamford, Orange Roller Bearing Co., Inc., Orange, N. J.
Roolway Bearings Co., Inc., 541 Seymour St.,
Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Self-Lubricating (Oilness)

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller

Timken Roller Bearing Co., Canton, Ohio,

BEARINGS, Thrust

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North
Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafriir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg.,
Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia,
Pa.
Norma-Hoffman Bearings Corp., Stamford. Pa. Norma-Hoffman Bearings Corp., Stamford, Conn. Orange Roller Bearing Co., Inc., Orange, N. J. Rollway Bearing Co., Inc., Syracuse, N. Y. Timken Roller Bearing Co., Canton, Ohio.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

BENCHES, Work, and Bench Legs

Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.

Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y. Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III. Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicogo, III.

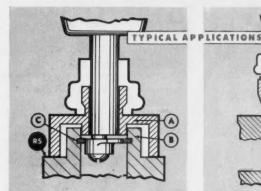
(Continued on page 304)

302-MACHINERY, March, 1955

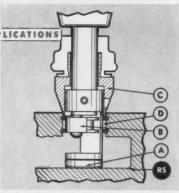
For more information on products advertised, use Inquiry Card, page 257

Waldes Truarc Grooving Tool Out-Performs Conventional Recessing Tools

SAVES TIME! CUTS COSTS! NEEDS NO SKILLED LABOR!



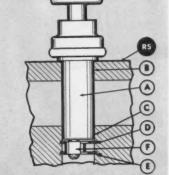
Clearing Obstructions or Protrusions — Waldes Truarc Grooving Tool with special bushing with high shoulder A in order to clear obstruction B on reference surface RS so groove can be properly located in bore.



Locating Grooves from Bottom of Hole or Blind Hole—Use of bottom adaptor A and double cutter B. Bushing C pilots tool into bore D while bottom adaptor acts as stop to locate grooves from reference surfaces RS below bore.



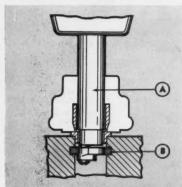
AMAZINGLY VERSATILE! The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even unskilled labor can perform and maintain high precision, mass production operations.



Extending Reach of Tool — Waldes Truarc Grooving Tool assembled with extended bushing A increases normal range of tool in order to reach proper groove location in bore. Bushing also registers on reference surface RS of workpiece while piloting tool at two points B and C inside bore. Two grooves D and E are cut simultaneously with double cutter F.

WIDE CUTTING RANGE! The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.000 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

SEND YOUR PROBLEM TO WALDES! Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.



Small Diameter Bore — Need for Wide Groove — Great versatility of tools allows A-2 Tool to accept stepped down spindle and cuttershaft assembly A. Provides cutting capacity in a bore normally within the range of smaller A-1 Tool. Illustrated, larger tool capacity necessary to cut groove diameter B exceeding normal capacity of standard A-1 Tool.



WRITE NOW FOR 20 PAGE TECHNICAL MANUAL CONTAINING FULL ENGINEERING DATA

WALDES



GROOVING TOOL

MADE BY THE MANUFACTURERS OF WALDES TRUARC RETAINING RINGS.
WALDES KOMINOOR, INC., 47-16 Austel Pl., L.I.C.1, N.Y. Waldes Truerc Grooving Tool mfd. under U. S. Pat. 2,411,426



M-037

Waldes Kohinoor, Inc., 47-16 Austel Place Long Island City 1, New York

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

anie

Title_

Company

Business Address_

City___

Zone State

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-303

for A BETTER PRODUCT ...

USE

FAIRFIELD **GEARS**

If GEARS are a vital part of the product you make, there is no finer recommendation for the QUALITY of your product than to be able to say it is equipped with "FAIRFIELD GEARS."

Long producers of the gears needed in high grade trucks and tractors, Fairfield now brings the same standards for GEAR PERFORMANCE to a wide variety of products: Agricultural Implements . . . Power Shovels . . . Machine Tools . . . Diesel Locomotives . . . Road Graders ... Lift Trucks ... Road Rollers . Pump Drives ... Winches ... Military Vehicles . . . and a host of others.

Fairfield's facilities are unexcelled. Here "under one roof" in a new and ultra modern plant designed especially for the purpose, Fairfield has everything needed for producing all kinds of gears: spur ... herringbone ... spiral bevel ... ground tooth spiral bevel...straight bevel...coniflex bevel...hypoid...zerol...worms and worm gears...splined shafts...differentials. Get acquainted with Fairfield's engineering and production facilities. Your inquiry will receive prompt attention. FAIRFIELD MANUFACTURING COMPANY, 2331 South Concord Road, Lafayette, Indiana.



SPECIAL PURPOSE VEHICLES Fine Gears Made to Order



BENDING MACHINES, Hydroulic

merican Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

Ohio.

Baldwin-Lima-Hamilton Cerp., Eddystone Dlv.,
Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo,
N. Y.

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg Co., Chambersburg, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,
III.
Hydraulic Press Mfg. Co., 30 Lincoln Ave.,
Mt. Gilead, Ohio.
Lake Erie Engrg Corp., Kenmore Sta., Buffalo,
N. Nigngra, Machae & Tool Works, 683 North-

N. Y.
Niagara Machne & Tool Warks, 683 North-land Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Ken-wood Ave., Chicago, III.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich. Pangborn Corp., Hagerstown, Md. Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y. N.Y. Ingersoll-Rand Co., Phillipsburg, N. J. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BLUING LAYOUT

Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa. Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, III. U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Hill Acme Co., 1201 W. 65th St., Cleveland z, Ohio. Landis Machine Co., Inc., Waynesboro, Pa. National Machinery Co., Tiffin, Ohio. New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only) Bethlehem Steel Co., Bethlehem, Pa. National Acme Co., 170 E. 131st St., Cleve-land, Ohio. Ottemiller, W. H., & Co., York, Pa. Russell, Burdsoll & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York Electric Co., 22801 St. Clair Ave., land, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill. Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill. Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.

(Continued on page 306)

Reliance

SPRING LOCK WASHERS

Keep Bolted Assemblies

Tighter Longer

Keliance Spring Lock Washers are designed and manufactured to combat the natural enemies of bolted assemblies; i.e., vibration, shock, twist, wear, expansion, contraction and bolt elongation. It is little wonder, therefore, that you find Reliance Spring Lock Washers on everything from toasters to tanks, from lathes to locomotives. They are specified by designers and production men because of the non fatiguing properties of the cold drawn spring steel. Their helical coil design also provides



maximum reactive tension with a wide range of reaction. Reliance Spring Lock Washers help create more confidence in your product because they help keep bolted assemblies tighter longer.

SEND FOR ENGINEERING FOLDER W-50

Special Message to Distributors

We are looking for distributors to handle the Reliance Spring Lock Washer line. If you are interested in a product with a profit potential and wide acceptance, backed up with national advertising, write for more information today.

HY-SERVICE ROUND EDGE

DOUBLE COIL

SPRINGLOX

WIDE BEARING

WOODSPRING

NONLINK POSITIVE



Chicago

MANUFACTURING COMPANY



San Francisco • Montreal



Bullard Co., Brewster St., Bridgeport 2, Conn. Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y. Cross Co., 3250 Bellevue, Detroit 7, Mich. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. 32, Mich. Foote-Burt Co., 1300 St. Clair Ave., Cleveland Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St. Rockford, III.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, III.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING AND TURNING MILLS, Vertical American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio. Baird Machine Co., 1700 Stratford Ave., Strat-ford, Conn. Bullard Co., Brewster St., Bridgeport 2, Conn. Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

BORING BARS

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac. Wis.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich. 30, Pa.
Gairing Tool Co., 21225 Hoover Ko., Delian St., Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo

BORING, DRILLING AND MILLING MACHINES, Horizontal

MACHINES, Horizontal

(Floor, Planer or Table Types)
Cincinnati Gilbert Machine Tool Co., 3366
Beekman St., Cincinnati 23, Ohlo.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and
Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit
32, Mich.
Giddings & Lewis Machine Tool Co., Fond du
Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn.
R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co.,
12302 Kirby Ave., Cleveland 8, Ohio.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Portage Machine Co., 1069 Sweitzer Ave.,
Akron 11, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave.,
Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.

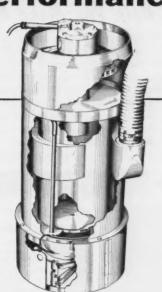
BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn. Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Miching Mch. Co., 2442 Douglas St., Rockford, Ill. (Continued on page 308)

The all New USTSNAIRE







Abrasive offers to all users of grinding machines for the first time the Feifel DUSTSNAIRE the scientific answer to the

grinding dust problem. May we send you details on this compact, dependable unit? Write for DUSTSNAIRE catalog. Abrasive Machine Tool Company, 12 Dunnellen Road, East Providence 14, Rhode Island.



Guaranteed to remove all particles 5 microns or larger,

than 1.5

having a specific gravity of more



COST CUTTING TOOLS



Shop Proved "Jack Lock"

Face, Shell, Shank, Half-Side and Staggered Tooth

MILLING CUTTERS

High Speed, Alloy or Carbide Tipped Blades

Help You Make Bigger Profits

● Engineered to meet modern milling practices—McCrosky Jack-Lock Milling Cutters combine the rigidity of solid tools with the greater economy—longer life—the easy, positive locking of each blade, without hammering—and the quick release and accurate blade adjustment of McCrosky shopproven nationally recognized Jack-Lock Wedge.

Department superintendents, foremen and operators have found that there's nothing better or cheaper, than McCrosky Milling Cutters. You can't keep competitive with less. Why gamble? Write for Bulletin 17-M today.

COST MEEROSKY

Engineering and Sales Representatives in the Principal Cities

TOOL

CORPORATION



McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Milholland, W. K., Machinery Co., 6402 Westfield Blyd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Taft-Peirce Mfg Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt. Chandler Tool Co., 514 Ohio Ave., Muncie, Ind. Cross Co., 3250 Bellevue, Detroit 7, Mich. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Heald Machine Co., 10 New Bond St., Worcester 6, Mass. Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind. Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich. National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind. New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati Bickford Tool Co., Green Bay, Wis. Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
York 17, N. Y.
York 17, N. Y.
York 17, N. Y.
York 12, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

BORING TOOLS American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati,

Paddock Rd. and Tennessee Ave., Cincinnari, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237
Roosevelt Park Annex. Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Irth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Galring Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Moss.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending
Bliss, E. W., Co., 1375 Raff Road, S. W.,
Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves.,
Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton
1, Ohio.

(Continued on page 310)

SEE HANNIFIN FOR ALL YOUR **AIR CONTROL EQUIPMENT NEEDS**

SERIES "A" AIR CYLINDERS

Made in 11 bore sizes from $1\frac{1}{2}$ " to 14"...13 standard mountings...many combinations. Extremely close tolerances insure accurate, easy mounting. Steel heads. Cylinders of hard-drawn, high strength brass honed to a satin finish. Piston rods ground and polished then hard chrome plated for extreme smoothness as well as corrosion resistance.

TYPICAL MOUNTING STYLES



Double Rod End





Rod End Flange







Side Lugs



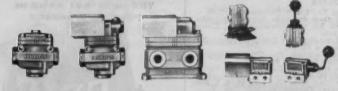


WRITE FOR BULLETIN 213

Just off the press. The easiest catalog to use in the cylinder business. Write today.

HANNIFIN AIR CONTROLS

Hannifin has the most complete line of air control valves. Exclusive designs, many types, for hand, foot, cam or solenoid control of air cylinders, presses, and other air-operated equipment. Ask for recommendations.





DISC-TYPE VALVES

Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation.

WRITE FOR CONTROL VALVES CATALOG

The complete air centrels catalog! Write for your copy today.



P-M PILOT-MASTER VALVES

The P-M line provides faster, easier operation for the simplest to the most complicated air-operated circuit. 2-Way, 3-Way and 4-Way Master Valves and Solenoid Pilot-Master Valves. . . also direct operated 3-Way and 4-Way valves with a wide choice of operating heads.

Hannifin Corporation, 509 South Wolf Road, Des Plaines, Illinois Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

PERIE S

BIG PORGING HAMMER

The days of the old-fashioned "Meller-drammer"



Grandpa and all the rest of his crew rode to work on a

bicycle built for two.

We put in a 60 hour



long week . . .

For 20 cents an

hour wage, at peak . . .

And, our boss, when



things were going fine . . .

For himself a



10 dollar check would sign!



Even then, Erie was THE GREATEST NAME IN FORGING HAMMERS



"IN OUR SOTH YEAR" ERIE FOUNDRY CO. ERIE, PA.

Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, III. Ferracute Machine Co., Bridgeton, N. J., Verson Allsteel Press Co., 93rd St. and S. Ken-wood Ave., Chicago, III. Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

Amercan Broach & Mch. Co., Ann Arbor. Mich. Amercan Broach & Mch. Co., Ann Arbor.
Mich.
Carboloy Dept., General Electric Co., Box 237,
Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta.,
Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O. Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson,
Maional Broach & Mch. Co., 5600 St. Jean
Actional Broach & Mch. Co., 5600 St. Jean
Actional Broach & Mch. Co., 5600 St. Jean
Messon Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Millng Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta.,
Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland
B, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson,
Mass.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

Bronze Co., Waterbury 20, Conn. Bunting Brass & Bronze Co., Spencer and Carl-ton Aves., Toledo, Ohio. Johnson Bronze Co., New Castle, Pa. Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc. Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio. Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio. American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engra. Co., Chambersburg, Pa. Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc. BUSHINGS, Brass, Bronze, Carbide, Etc.
Boston Gear Works, 3200 Main St., North
Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio,
Haynes Stellite Div., Unon Carbide & Carbon
Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

(Continued on page 312)

IN TODAY'S

forge shop

WHERE FASTER FORGING REQUIRES AN **ALL-STEEL HAMMER**



WHEN each hammergang's 'down time' is so costly if mechanical failure sets in,

WHEN competitive bidding in mass production requires every effort to be costed at minimum

WHEN product perfection must be taken for granted as buyers specify less and less tolerance allowances

The tireless performance of the all-steel construction (in all stressed parts, upper works, frames, and anvils) makes

ERIE, MORE THAN EVER. THE GREATEST NAME IN FORGING HAMMERS



"IN OUR SOTH YEAR" ERIE FOUNDRY CO. ERIE, PA.



In development for three years . . . formulated by leading carbide engineers . . . produced in the newest plant by the most modern equipment . . . tested on long runs by the country's leading carbide-using plants . . . Valenite is the "CONSTANT QUALITY" TUNGSTEN CARBIDE for your production line.

Made right for modern hi-speed production, Valenite's "CONSTANT QUALITY" performance cuts down-time, saves money.

Test Valenite for yourself. Compare the results. You'll find that Valenite "CONSTANT QUALITY" TUNGSTEN CARBIDE tips and tools are the answer to better production machining.

Write for your complete Valenite tips and tools catalog.

Please send without charge the new Valenite Catalog—A-3			
Name		Title	
Company			
Address			



VALENITE

METALS CORPORATION

Box 205 • Royal Oak, Michigan

New <u>UFKIN</u>

Magnetic Base Tools Speed Your Work



High intensity lighting (500 foot candles at 3" working distance) coupled with 4-power magnifier. Burn danger eliminated . . . unit operates at about body temperature. The two 5" lamps are protected by a plastic chip shield. Easily adjusted goose neck with full swivel at base. Heavy duty permanent magnets in base . . . attaches firmly to any round or flat ferrous surface. Ideal for industrial laboratories, tool rooms, die shops, bench inspection, surface grinding, precision lathe work, etc.

No. 350X



MITI-MITE Magnetic Base SURFACE GAGE

May be used as both a surface gage and indicator holder. Permanent magnet in base can be turned off for easy positioning. Fully adjustable spindle - scriber can be used below base when desired. Has fine adjustment screw for precise setting. Spindle is isolated from magnetic field. Comes complete with 4" and 7" spindles and indicator holder attachment.



No. 300B

BUY JUFKIN TAPES . RULES . PRECISION TOOLS FROM YOUR DISTRIBUTOR

350 THE LUFKIN RULE CO., Saginaw, Michigan 132-138 Lafayette St., New York City . Barrie, Ontario

BUSHINGS, Hardened

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Forser, Mich. Danly McChine Specialties, Inc., 2107 S. 52nd McChine, Chicago SO, Ill. Ex-Cell-O Corp., 1200 Oakman Bivd., Detroit 32, Mich. Detroit 32, Mich. Chicago St., Worcester, Mass. U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa. U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

CALIPERS

Ames, B. C., & Co. (Dial) Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Starret, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y. N. Y. Fellows Gear Shaper Co., Springfield, Vt. Frew Machine Co., 121 East Luray St., Phila-delphia 20, Pa. Pratt & Whitney, West Hartford 1, Conn. Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Machine Saird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

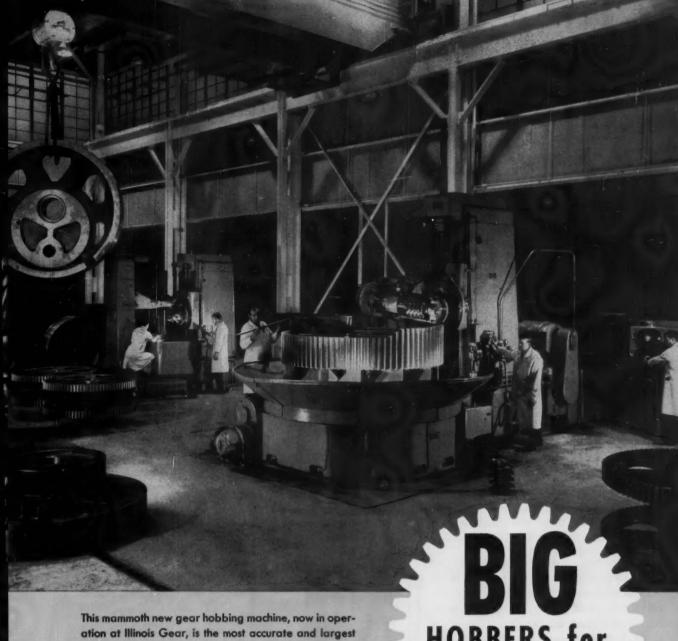
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J. N. J. Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn. Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich. Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa. Kennametal, Inc., Latrobe, Pa. Metal Carbides Corp., Youngstown, Ohio. Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich. Valenite Metals Corp., Box 205, Royal Oak, Mich. Wesson Co., 1220 Woodward Helphire, Physicarbon Co., 1220 Woodward Helphire, Physica Mich.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor
Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating (Continued on page 314)



This mammoth new gear hobbing machine, now in operation at Illinois Gear, is the most accurate and largest machine in existence for fast precision hobbing of BIG gears. Equipped with 12" x 15" ground hobs, the largest ever made, it does precision work on blanks up to 100,000 lbs. and 134 inch diameter, 3½ inch C.P. and 54 inch face. Spur, helical and worm gears can be cut to spacing tolerances as low as .0003 inch.

Whatever your needs, you'll find the right machine and tool for your job at Illinois Gear.

BIG HOBBERS for ILLINOIS GEAR

Look for this mark (LL) . . . the symbol on finer geers



Gears for Every Turpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

2108 NORTH NATCHEZ AVENUE . CHICAGO 35, ILLINOIS





There is NO COMPARISON with a Jacobs

If you don't wear a gold service pin you probably won't remember when "Jacobs" wasn't the name for the finest drill chuck. Since Mr. A. I. Jacobs started it all, back in 1903, continual painstaking and specialized research has been lavished on Jacobs Chucks.

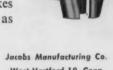
The Plain Bearing Jacobs Chuck pictured is undoubtedly the best known in the world ... and with good reasons. It is a precision chuck capable of greater accuracy than any comparable chuck made today. It is a strong chuck, longer lasting on the job. It is a hardholding chuck with a grip of tremendous

These good reasons add up to the unquestioned, uncompromising quality that makes your selection of drill chucks as easy as remembering the name Jacobs.

JACOBS AND YOUR LOCAL DISTRIBUTOR

are ready to deliver the chucks you need and the service you deserve. first in chucks . . . first in service





West Hartford 10, Conn.



CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa. Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa. Bunting Brass & Bronze Co., Spencer and Carl-ton Aves., Toledo, Ohio. Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn. Lehigh Foundries, Inc., 1500 Lehigh Dr., Fas-ton, Pa. Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio. Bethlehem Steel Co., Bethlehem, Pa. Brown & Sharpe Mfg. Co., Providence, R. I. Chambersburg Engineering Co., Chambersburg, Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludium Steel Corp, Pittsburgh, Pa. Bethlehem Steel Co., Bethlehem, Pa. Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa. Pa.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Haynes Stellite Dv., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J., Lebanon, Pa.
U. S. Steel Corp., Columbia Steel Co., Div.,
436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn

CENTERING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y. Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
S-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt. Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Indis, N. Y. Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe

CENTERS, Lathe

Axelson Mfg. Co., P. O. Box 15335, Verona St.,
Los Angeles S8, Cal.
Carboloy Dept., General Electric Co., Box 237,
Roosevelt Park Annex., Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chicago, III.
Cleveland Twist Drill Co., Cleveland, Ohio.
Dakon Tool & Machine Co., Inc., 1836 Guilford
Ave., New Hyde Park, N. Y.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30. Pa.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, III.
South Bend, Lath.
Super Tool Co., 1250 Hoover Rd., Detroit 13,
Mich.
Wesson Co., 1220 Woodward Heights Blyd. St, South Level.
Styper Tool Co., 21650 Hoover Ka., School Co., Mich.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.
(Continued on page 318)

BUTTERFIELD



A COMPLETE LINE OF QUALITY cutting

tools is now available from your Butterfield distributor. Reamers are made to the same exacting standards as Butterfield Taps, Dies, Milling Cutters, Drills, Counterbores and End Mills.

BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

FOR FAST, ECONOMICAL SERVICE

DISTRIBUTO













Here's another reason it pays to get a proposal from Fosdick

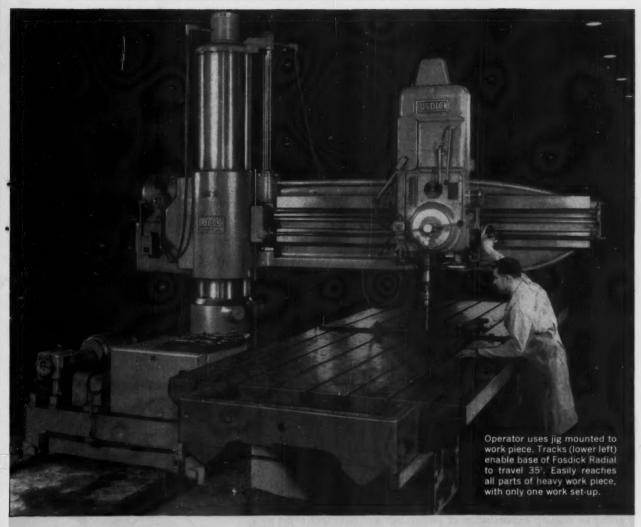
No Need to Move This 13-Ton Work Piece!

Work stays put, throughout entire drilling operation. The Fosdick Traveling Base Radial does all the moving. With its 8' arm and 35' track, it easily reaches every part of the heavy work piece—a 72" x 16' table for a Rockford Hy-draulic Planer.

The Fosdick Radial enables operator to drill hundreds of holes in one work setting. Arm can be rotated on column to reach smaller-work rush jobs on other end or other side of track, without disturbing heavy work set-up. Track clamps and hydraulic column clamp prevent side movement of column, assure accuracy and speed of drilling.

If your drilling work includes heavy pieces like the planer table shown, you can cut excessive handling time to a bare minimum with a Fosdick Traveling Base Radial. When you need drilling equipment, always be sure to get a proposal from Fosdick.





Traveling Base Radial Cuts Handling Time

"Savings run up to 50% on jobs where handling time is a large part of total time. Fosdick performance has been excellent!"

says K. M. Allen, Executive Vice President Rockford Machine Tool Company, Rockford, Ill.

Need Drilling Equipment? Get a Proposal from Fosdick!



Radial Drills



Jig Borers



Sensitive and Upright Drills



Padial Drille



Automatic Positioning Machines



THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-317

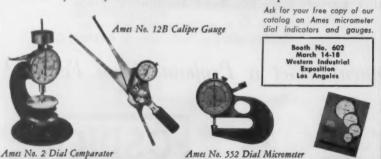


Over 16,000,000 cycles without wear or loss of accuracy... how many more will they complete?

Several Ames Long Range Dial Indicators with plain bearings are currently giving an amazing demonstration of performance and endurance under test. Several Model 282 Indicators, selected at random from our stock, still have their original accuracy - after more than 16,000,000 cycles each, at 240 strokes a minute, 9 hours a day.

This outstanding record is made possible by Ames' use of simple basic design, highest quality materials, rugged construction . . . and expert craftsmanship.

How many more cycles will these Ames indicators complete?



B. C. AMES CO. Waltham 54. May Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

CHAINS, Power Transmission and

Boston Gear Works, 3200 Main St., North Quincy, Mass. Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa. Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

CHUCKING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.

Skinner Chuck Co., 344 Church St., New Britain, Conn.

Tomkins-Johnson Co., Jackson, Mich.

Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Gleason Works, 1000 University Ave., Roches-ter, N., Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill

CHUCKS, Drill

Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

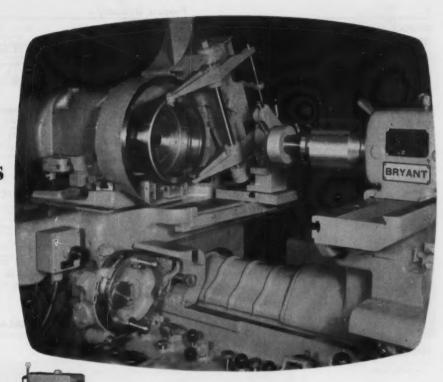
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y. Gisholt Mch. Co., Madison 10, Wis. Scully-Jones & Co., 1903 Rockwell St., Chi-cago 8, III. Universal Engineering Co., Frankenmuth 2, Mich.

(Continued on page 320)

SHOE
CENTERLESS
GRINDING
WITH...



BRYANT internal grinders gives you HIGHER PRODUCTION and

LOWER COSTS

Experience resum testing and futures help make Report Internal

Experience-proven tooling and fixtures help make Bryant Internal Grinders exceptionally accurate . . . efficient . . . productive.

The shoe-type centerless internal grinding fixture is typical. Extremely thin wall rings can be shoe centerless ground to close tolerances. Straight holes, tapered holes and contours, having cylindrical, conical or other surfaces of revolution can be ground by this method.

Shoe centerless grinding ensures bore grinding to a uniform wall thickness with concentricity held to less than .0001". It is particularly successful when previous O.D. and face grinding operations have been closely controlled. Distortion caused by conventional clamping is eliminated.

Shoe centerless grinding speeds up loading and unloading of work parts, whether manual or automatic. Change-over from job to job is easier and faster than with conventional grinding fixtures.

Bryant grinders offer you operating economy—as well as peak production rates. Their adjustable precision alignment helps ensure maximum original accuracy throughout their lives. They require only a minimum of maintenance. Factors like these cut cost per piece.

WRITE for our "Alignment" booklet. Ask, too, for a reservation card for our sound, color movie, "Alignment for Better Internal Grinding"—free showings arranged for engineering groups.



chucking grinder co.

SPRINGFIELD, VERMONT, U.S.A.

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

A- WORK CENTER

C- ROLLER CLAMPS

D- SHOES

A magnetic driver plate is used

whenever possible, eliminating

the roller clamps.

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.

CHUCKS, Lathes, etc.

CHUCKS, Lathes, etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.

Bullard Co., Brewster St., Bridgeport 2, Conn.

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.

Gisholt Mch. Co., Madison 10, Wis.

Jacobs Mfg. Co., West Hartford, Conn.

Jones & Lamson Mch. Co., Springfield, Vt.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

Skinner Chuck Co., 344 Church St., New Britaln, Conn.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Prvoldence, R. I. DoAll Co., 254 Laurel Ave., Des Plaines, III. Hanchett Magno-Lock Corp., Big Rapids, Mich. Taft-Pelirce Mfg. Co., Woonsocket, R. I. Walker, O. S., Co., Inc., Warcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

CHUCKS, Quick Change and Safety
Errington Mechanical Laboratory, 24 Norwood
Ave., Stapleton, S. I., N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Cor., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St.,
Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2,
Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Errington Mechanical Laboratory, 24 Norwood
Ave., Stapleton, S. I., N. Y.
Jacobs Mig Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St.,
Chicago. III. Chicago, III.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, III.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Brown & Sharpe Mfg Co., Providence, R. I. Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, III. Lufkin Rule Co., Hess Ave., Soginaw, Mich.

Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, III. Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass. Starrett, The L. S., Co., Athol, Mass. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brew-ster St., Bridgeport 2, Conn. Oakite Products, Inc., 19 Rector St., New York, N. Y. Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

CLUTCHES

Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, III.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410
Catherine St., Rockford, III.
Twin Disc Clutch Co., 1361 Racine St., Racine Wis.
Verson Allsteel Press Co., 12d St. 8, 6 March Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.

COLLARS, Safety

Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave.,
Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend, Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkirs-Johnson Co., Jackson, Mich.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zogar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, III.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St.,
New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa. Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y. N. Y. Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Po. National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lop-(Continued on page 322)

improved delivery



Get the full story on all the advantages

OF GRAND RAPIDS UNIVERSAL CUTTER AND TOOL GRINDERS

It's true, they have been hard to get be-

cause every model offers extra value. The Model 62, for instance, features four-speed spindle drive, universal positioning of elevating hand wheel, anti-friction ways, more vertical capacity, longer swing, one-shot lubrication system.

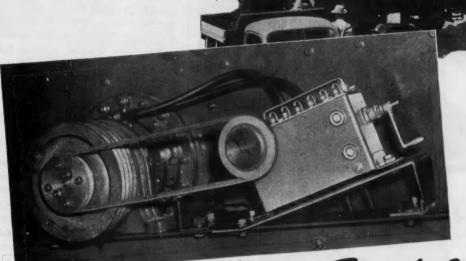
The many other Grand Rapids Cutter Grinders are also on improved delivery schedules. Send coupon for complete information

425 Straight Ave., Grand Rapids, Mich Please send me the following literature with out obligation: Cutter and Grinder Literature Surface Grinder Literature NAME POSITION FIRM FIRM ADDRESS		R & LIVINGSTON CO.
out obligation: Cutter and Grinder Literature Surface Grinder Literature NAME POSITION FIEM	-	
Cutter and Grinder Literature Surface Grinder Literature NAME POSITION FIEM		
Surface Grinder Literature NAME POSITION FIEM		
NAME POSITION FIRM		
POSITION		
FIRM	☐ Surrace Gr	inder Liferature
		inder Liferature
FIRM ADDRESS	NAME	rinder Literature
	NAME POSITION	rinder Literature



machines of
great performance
use the most dependable
oiling system
ever developed

A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 8 48 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.



MADISON-KIPP Fresh Oil

... by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors.

You will definitely increase your production potential for years to come

by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.



MADISON-KIPP CORPORATION

203 WAUBESA STREET . MADISON 10, WIS., U.S.A.

- Skilled in Die Casting Mechanics
 - Experienced in Lubrication Engineering
- Originators of Really High Speed Air Tools

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-321

For CONSISTENT REPEAT READINGS of Size — Runout — Taper — Concentricity...

INDI-AC Electronic Indicator, for allaround surface plate work and for checking setups and runout on the machine. Reads .0005"/.000050" or .0001"/.000010" per scale division.





PAR AC Electronic Production Gage for high-precision repetitive gaging in the shop or inspection department. Reads .0005"/.000050" or .0001"/.000010" per scale division.

MICRO-AC Electronic Microcomparator, for gage room use and ultra-precision production gaging. Reads .000010"/.000001" per scale division — or .000001"/.0000005"



These gages are stable and friction-free — give consistent repeat readings. • They are used with a recorder to provide a pen-drawn record of runout, size deviations, etc. • Gage heads and amplifiers are used with special fixtures — and for automation applications. • BULLETIN 542 describes the equipment — tells how it works — shows numerous applications. May we send you a copy? Write—

735-2 CARNEGIE AVE.

CLEVELAND 15, ONIO



Cleveland

ELECTRONIC GAGING EQUIPMENT Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Sheor-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Tray St., Chicago 23, Ill.
Sun Oil Co., 1308 Walnut St., Philadelphia, Pa. Texas Co., 135 E. 42nd St., New York, N. Y.

COMPOUNDS, Resin and Moulding General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Axelson Mfg. Co., P. O. Box 15335, Verona St., Los Angeles 58, Cal. Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Enrar. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio
Ohio Co., Inc., 255 North 18th St.,

Ohio Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee. Clark Controller Co., Cleveland, Ohio. General Electric Co., Schenectady 5, N. Y.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford,

COOLANT SEPARATORS

See Separators, Oil or Coolant.

COUNTERBORES

Allen Mfg Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich. Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pon.



Holes on extremely close centers vary in diameter from $\frac{1}{16}$ " to $\frac{13}{16}$ ". The valve body has 33; the cover, 18.



"-BUT OUR PRODUCTION RUN IS LIMITED."

"SO WAS THE RUN ON THIS AUTOMATIC TRANSMISSION PART, BUT"....



HERE'S HOW ZAGAR TOOLING SAVED MONEY HAND OVER FIST

This aluminum die casting is processed in its entirety by Zagar planning, except for milling two faces. Two lines of Zagar standardized self-clamping drill jigs ream, tap and drill both valve body and cover. With 24 heads and 24 fixtures, Zagar performs work on 51 holes on

close centers. Step tools take care of reaming and burnishing. The fixtures were designed to compensate for slight inaccuracies in the die casting. Thus has Zagar engineering solved an acute problem of limited production without the purchase of costly special machines.



Ask on your letterhead for Bulletin "M-3."

ZAGAR TOOL, INC.

24000 LAKELAND BOULEVARD . CLEVELAND 23, OHIO



TOOLS FOR INDUSTRY and SPECIAL MACHINERY

CHRIST PLAS

The point is.

HOW MUCH DOES IT COST NOT TO INVESTIGATE?

Most diamond tools are similar in quality of diamonds used, precision manufacture and price; how do you determine which to buy? Ask yourself these questions: First, do I need a special tool designed for special application, or will a standard tool fit my needs and am I getting the most for the money spent on the dressing tools I now use or could my operations be improved.

We are selling diamond tools but more important we are selling the application of diamond tools. With your help we try to reduce costs by fitting the tool to the job.

Perhaps we have never had the opportunity of working with you on your problem, but the experience we have gained in helping others in similar situations gives us a broader view point to help you with your problems and the basis on which to build our recommendations.

Write us explaining your problems. Ask yourself this question: How much does it cost not to investigate?



CHRISTERSER Christensen Diamond Tools

division of



Send for the new catalog of Christensen Diamond Tools

Christensen	Diamond Product
1937 South	Second West
Salt Lake C	ity, Utah

Send catalog. Send catalog and contact me concern recommendations of the application of your diamond tools in	ning n our
plant.	
NAME	
ADDRESS	******
CITY	

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich. National Twist Drill & Tool Co., Rochester, Mich. Pratt & Whitney, West Hartford 1, Conn. Scully-Jones & Co., 1993 Rockwell St., Chi-cago 8, Ill. Starrett, The L. S., Co., Athal, Mass. Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor
Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

COUNTERSINKS
Chicago-Latrobe Twist Drill Works, 411 W. Onfario St., Chicago, III.
Circular Tool Co., Inc., 765 Allens Ave., Providence S. R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass. Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich. Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Super Tool Co., 21650 Hoover Rd., Mich. Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Brown & Sharpe Mfg Co., Providence, R. I. Millers Falls Co., Greenfield, Mass. Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sler-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass. Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J. Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc. (Continued on page 326)

New Machine Shaves INTERNAL GEARS Faster and to Closer TOLERANCES

This new Red Ring Model "GCR" is a high production, high precision shaving machine for a broad range of internal years. It provides two methods of shaving and many advantages which heretofore were available only on external year shaving machines.



- It will precision shave all spur or helical internals 3" to 12" PD, up to 4 diametral pitch with face widths to 2½".
- It will operate on an automatic and selective feed cycle.
- It provides the opportunity to use a new, rapid PLUNGE-CUT shaving cycle in addition to conventional shaving.
- Crowning by the Plunge-cut method is optional.
- . It will taper-shave gear teeth.

- It assures precision comparable to that established by Red Ring Machines for external gears.
- It reduces loading and unloading time to
 a minimum.
- It handles gears having integral shafts.

When using the automatic feed cycle a selected number of cutting strokes, each with its own selected increment of up-feed, can be combined with whatever idling strokes are desired. At the end of the cycle the machine automatically stops in the proper backlash position for rapid unloading.

If your manufacturing program includes internal gears, write for complete information on this new shaving machine.





NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Excessive Drill Costs! EQUIP Your Toolroom

Put an end to all those unnecessary, wasteful expenses involved from dull and inaccurate drills . . . obtain the best results from your drills by machine grinding them with an OLIVER DRILL POINTER. Machine ground to a perfect balance, Oliver ground drills are scientifically correct and theoretically perfect . . . each lip of the drill performs equal work. Drills ground the Oliver way last from 2 to 3 times longer than ordinary hand ground drills.



MODEL #21



MODEL #510

The Oliver machine grinds drills to cut faster and more accurately . . . to last longer . . . to produce more perfect holes. With an Oliver in your toolroom production schedules will be easier to keep, excessive drill costs will be eliminated, and imperfectly ground holes and rejects a thing of the past. Save money in your toolroom by increasing the efficiency, the wearing life of your drills ... machine grind them with an OLIVER DRILL POINTER.

No. 510 for drills 1/4" to 3"-2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.

No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to 1/2". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

"How To Produce More Holes With Your Drills!" See our catalog in Sweet's Directory

ADRIAN, MICHIGAN 1410 E. MAUMEE

MACHINE TOOLS by OLIVER include: AUTOMATIC DRILL GRINDERS TOOL & CUTTER GRINDERS DRILL POINT THINNERS TEMPLATE TOOL GRINDERS FACE MILL GRINDERS CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Spring-field, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
(Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Woltham Mch. Wks., Newton St., Waltham, Mass.

Mass. Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

CUTTERS, Keyseater
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Bivd., Detroit
32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Bivd.,
Ferndale, Mich.

CUTTERS, Milling

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.

Barber-Colman Co., Rock St., Rockford, Ill.

Brown & Sharpe Mfg. Co., Providence, R. I.

Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread).

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa., Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

Gorham Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.

Raynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

Kearney & Trecker Corp., Milwaukee, Wis. Kennametal, Inc., Latrabe, Pa.

McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.

National Twist Drill & Tl. Co., Rochester, Mich.

Onstud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

Fart & Whitney, West Hartford 1, Conn.

Scully-Jones & Co., 1903 Rockwell St., Chicago, Ill.

Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

Tomkins-Johnson Co., Jackson, Mich.

Union Twist Co., Athol. Mass.

Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor
Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burrs Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, grinding,

CUTTING AND GRINDING FLUIDS

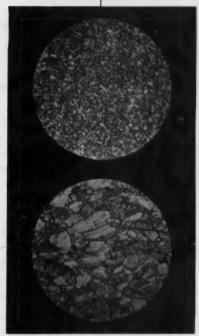
Continued and Grinding FLUIDS
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co.,
Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York,
N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Houghton, E. F., & Co., 303 W. Lehigh Ave.,
Philadelphia, Pa.

(Continued on page 328)

DURAFLEX ...

a NEW fine-grain phosphor bronze with 30% GREATER ENDURANCE LIMIT

FINE-GRAIN STRUCTURE IS THE MAIN REASON . . .



Micrographs (75x magnification) tell the inside story. Top, note the fine-grain structure of DURAFLEX. Compare it with the grain structure of ordinary phosphor bronze, bottom.

Try a FREE SAMPLE of

DURAFLEX

Sheet . . . up to 0.062'' thick Wire . . . up to $\%_{16}''$ diameter (approx.)

DURAFLEX* is a new, fine-grain phosphor bronze developed and sold only by Anaconda. Comparative fatigue tests show that the endurance limit of DURAFLEX is approximately 30% higher than for ordinary phosphor bronzes. In surface appearance surface smoothness and resistance to corrosion, it is equal to, or better than, other phosphor bronzes. Further, its formability is increased with no sacrifice in yield strength. DURAFLEX is a premium phosphor bronze in every way except cost; there's no increase in price.

If you're now using a hard-temper phosphor bronze, chances are that you can do the same forming in extra-hard temper duraflex. If you're looking for longer life in the parts you form, we'll be glad to send you a free sample of duraflex. Try it, test it, and you will agree that it's superior.

DURAFLEX fine-grain phosphor bronze

an ANACONDA produc

MADE BY THE AMERICAN BRASS COMPAN'

(In Canada: Anaca	rass Company, Waterbur anda American Brass Ltd., No try DurafLex. Please send	w Toronto, Ontario
	temper,	
wire in	temper,	diameter
	k to one of your metallurgis	
NAME	******************	*******
COMPANY	*****************	******
STREET		
CITY	ZONE	STATE



Steel...soft metals or plastics... small parts or odd shapes... Wilson tests them all

A FULL LINE TO MEET **EVERY HARDNESS** TESTING REQUIREMENT

FULLY AUTOMATIC

SEMI-AUTOMATIC

REGULAR

SPECIAL

SUPERFICIAL

TUKON MICRO & MACRO quickly...accurately

· Recognized as the leader, WILSON "ROCKWELL" Testers set the standards of hardness testing. In the laboratory or on the production line, wherever exact hardness must be checked, there is no substitute for WILSON.

Completeness of the WILSON line makes it unnecessary to compromise with makeshift testing methods. The WILSON organization is nation-wide. Our experts are available not only to help you select the exact tester best suited to your requirements but to consult with you on problems involving hardness tests.

Write for full information on WILSON "ROCKWELL" Hardness Testers, diamond Brale penetrators and accessories.

*Trademark Registered



Wilson Mechanical Instrument Division

AMERICAN CHAIN & CABLE

230-D Park Avenue, New York 17, N.Y.

Shear-Speed Chemical Products, Dlv. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich. Sinclair Refining Co., 600 Fifth Ave., New

York. Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, III. Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23 III. Chicago 23 III. Sun Oil Co., 1608 Walnut St., Philadelphia, Pa. Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St.,
Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton
1 Ohio.
Delta Power Tool Div., Rockwell Mfg. Co.,
614 G. N. Lexington Ave., Pittsburgh 8, Pa.

CUTTING-OFF MACHINES, Cold Sow See Sewing Machines, Circular.

CUTTING-OFF MACHINES, **Metal Band Saws**

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, III. DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

CUTTING-OFF TOOLS

Allegheny Ludium Steel Corp., Pittsburgh, Pa. Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAII Co., 254 N. Laurel Ave., Des Plaines, Ill. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hoynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y. Norton Co., 1 New Bond St., Worcester, Mass. Simonds Abrasive Co., Tacony & Fraley Sts., Philadelpha 37, Pa. Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P.O. Box 101, Toledo 10, Ohio. 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y. Cross Co., 3250 Bellevue Ave., Detroit 7, Mich. Ex-Cell-O Corp., 1200 Oakman Bivd., Detroit 32, Mich. Ingersoil Milling Mch. Co., 2442 Douglas St., Rockford, III.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio.
Moline Tool Co., 102 20th St., Moline, III.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Detroit 7, Mich. IHERE R-B Punches cut your costs





IN DIE DESIGNING

... you save "board time" by working with the standardized R-B concept of punches, die buttons, punch retainers and die button retainers. R-B standardized equipment reduces drafting time to cut your costs.

IN DIE CONSTRUCTION

because R-B punches, die buttons, punch retainers and die button retainers are furnished completely finished. R-B saves skilled die-maker's time to cut your costs.

IN DIE OPERATION

...you save "press time" because
R-B punches and die buttons are
instantly removed and replacements quickly inserted. Inherent
accurate alignment and positive
locking keep press down-time
at a minimum to cut your costs.

Use R-B Engineering Service for Your Tough Piercing Problems.

PUNCHES

RICHARD BROTHERS PUNCH DIVISION

ALLIED PRODUCTS CORPORATION

TDEPT. 75 . 12619 BURT RD. . DETROIT 23, MICHIGAN

Please send me additional information.

NAME_____TITI

COMPANY

ADDRESS _____

ZONE_STATE____

Also Produced in OTHER ALLIED PLANTS

SPECIAL COLD FORGED PARTS

STANDARD CAP SCREWS

PRECISION GROUND PARTS

SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-329



PIONEER

Impeller Pumps

ROLLWAY

Positive Displacement

PUMPS

For Coolants, Lubricants and Abrasive Liquids

0 to 174 gpm

Something More Than Quality and Performance

Rugged dependability and factory-tested performance are only a part of the story behind Pioneer and Rollway pumps.

For 23 years Pioneer has specialized in the design and manufacture of impeller and positive displacement type pumps. This experience led to the development of a complete pump line of over 400 models. The model shown above is one of a complete line of flange-mounted and submergible type pumps which provides strict conformity to J. I. C. standards.

Pioneer pumps offer manufacturers many important advantages, such as the savings effected through the selection of standard pumps to meet custom requirements. Another important consideration in selecting Pioneer pumps is the unusual opportunity for standardization and interchangeability.

Pioneer application engineers will welcome the opportunity to discuss your pump requirements with you.

Send Today for this FREE Catalog.



PIONEER PUMP DIVISION DETROIT HARVESTER COMPANY

Sales and Engineering Offices: 14300 Tireman Ave. • Detroit 28, Michigan Manufacturing Plant: Paris, Kentucky

CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, III. Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass. Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, III.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, III.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co. Inc., 810 Center Ave., Logansport Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, III.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

CYLINDERS, Pneumatic

Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, III.

DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester, N. Y. Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III. Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass. Heald Mch. Co., 10 New Bond St., Worcester 6, Mass. Lufkin Rule Co., Hess Ave., Saginaw, Mich. Taft-Peirce Mfg. Co., Woonsocket, R. I. Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

PESISNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Aye., Stratford, Conn.

Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead
St., Hartford, Conn.

Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

Modern Ind. Engra. Co., 14230 Birwood Ave.,
Detroit 4, Mich.

Pratt & Whitney. West Hartford 1, Conn.

Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio

Snyder Tool & Engra. Co., 3400 E. Lafayette,
Detroit 7, Mich.

Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, Ill.

Turchan Follower Machine Co., 8259 Livernois
& Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS

Christensen Diamond Prod., 1937 S. Second West, Salt Lake City, Utah Smit, J. K., & Sons, Inc., Murray Hill, N. J.

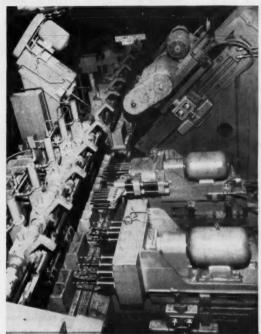
DIE-CASTING

See Castings, Die.

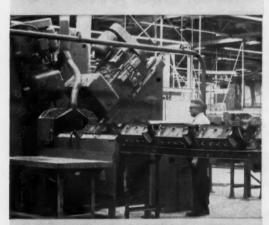
DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. Lake Erie Engineering Corp., Kenmore Station, Buffelo, N. Y. (Continued on page 332)

VICKERS HYDRAULICS Helps Cut Costs at PACKARD on Wide Variety of Jobs in New V-8 Engine Plant



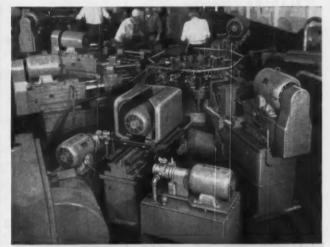
Kearney & Trecker machine for drilling and counterboring bearing caps. Note Vickers Traverse and Feed Cycle Control Panels visib on two heads; advantages include smooth and constant feed rates, easy adjustability, compactness and simplified installation.



Three Greenlee Transfer Machines in automatized cylinder block line use Vickers Hydraulics. Compact Vickers Traverse and Feed Cycle Control Panel shown on head assures smooth and constant feed rate regardless of fluctuations in tool resistance or changes in hydraulic pressure or volume.

Representative of the many and varied production machines equipped with Vickers Hydraulics in the new Packard V-8 Engine Plant at Utica, Michigan are those shown here. Among the advantages of Vickers Hydraulics are: (1) simplification of design, (2) adaptable to automation, (3) ease of providing interlocks and overload protection, (4) ease of maintenance with minimum down time. Equally important, Vickers Hydraulics gives you the benefits of a nation-wide and full-time field engineering and service organization.

The Vickers Application Engineer near you will be glad to show you the benefits you can obtain by using Vickers Hydraulics. Write for a copy of Bulletin 5002.



Michigan Drill Head Co. 8 station dial machine for connecting rods and caps, Vickers Hydraulic Power Units shown are complete hydraulic "packages" (pump, electric motor, valves, oil reservoir, filter, etc.) that simplify design, and save installation and maintenance costs.



Udylite Automatic Processing Machine saves space and assures more uniform quality by using Vickers Hydraulics to raise, lower and transfer cam shafts through cleaning, coating and rinsing baths in "Lubriting" process.

7109

VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

1403 OAKMAN BLVD. . DETROIT 32, MICH.

Application Engineering Offices:

ATLANTA • CHICAGO AREA (Broakfield) • CINCINNATI • CLEVELAND • DETROIT • HOUSTON LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mr. Lebanon) • ROCKESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



ed for more efficient. LAYOUT, INSPECTION. CHECKING, LAPPING, WELDING AND ASSEMBLY WORK



including CHALLENGE LAYOUT SURFACE PLATES

in 16 sizes, precision ground or planer finished - for a wide range of functions. Plates can be grooved and keyed so that two or more can be assembled and mounted into one complete unit. With "T-Slots" or with grooving, scoring or machining.



SEMI-STEEL SURFACE PLATES

made of fine-grain special analysis semi-steel castings, heat treated. Three-point suspension with heavy, deep ribs on the underside.

PLUS ..

Clamp Edge Layout Plates Checking Tables Welding Tables Bench Plates and Blocks

Send for free copy of Challenge Catalog showing complete line of precision equipment.

THE CHALLENGE MACHINERY CO.

Office, Factories and Show Room GRAND HAVEN, MICHIGAN

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio. Onio. Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill. Verson Allsteel Press Co., 93rd St., and S. Ken-wood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. Kennametal Inc., Latrobe, Pa. Metal Carbides Corp., Youngstown, Ohio. Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio. Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd
Ave., Chicago 50, III.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Producto Mch. Co., 990 Housatonic Ave.,
Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.

DIEMAKING MACHINES

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Grob, Inc., Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Mouree St.,
Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio. Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd
Ave., Chicago 50, III.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave.,
Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, U. S. Tool Co., Inc., 255 N. 1811 VI., N. J. Wales-Strippet Corp., North Tonawanda, N. Y.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-nati, Ohio. Baldwin-Lima-Hamilton Corp., Eddystone Div., Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa. Cincinnati Milling Mch. Co., Cincinnati, Ohio. Gorton, George, Machine Co., 1110 W. 13th St. Racine, Wis. Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y. Pratt & Whitney, West Hartford 1, Conn. Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Fa. Kearney & Trecker Corp., Milwaukee, Wis. Verson Alisteel Press Co., 93rd St., & S. Ken-wood Ave., Chicago, III.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept, General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich. Chambersburg Engrg. Co., Chambersburg, Pa. Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, III.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Richard Bros., Div., Allied Products Corp., 12619 Burt Rd., Detroit 23, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

Taft-Peirce Mfg. Co., Woonsocket, R. I. Verson Allsteel Press Co., 93rd St., and S. Ken-wood Ava., Chicago, III. Wales-Strippet Corp., North Tonawanda, N. Y. Waltham Mch. Wks., Newton St., Weltham, Mass.

DIES, Threading

DIES, Threading
Butterfield Div., Union Twist Drill Co., Derby
Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd.,
Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New
Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350,
Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn. Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y. Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. Prott & Whitney, West Hartford 1, Conn. Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass. Sheffield Corp., 721 Springfield St., Dayton 1, Obio

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., I New Bond St., Worcester, Mass. Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment.

DOYELL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Allen Mrg. Co., 133 sherach S., Conn.
Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd
Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave.,
Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.

DRESSERS, Grinding Wheel

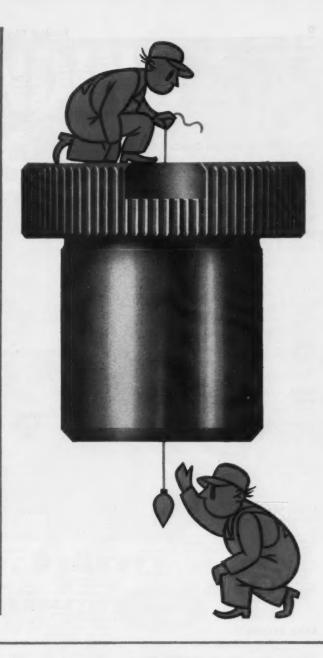
DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237
Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta.,
Detroit 13, Mich.
DoAli Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32 Mich.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave.,
Bridgeport, Con.,
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio Ohio Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich. (Continued on page 334)

FOR PERFECT ALIGNMENT...

UNIVERSAL DRILL BUSHINGS

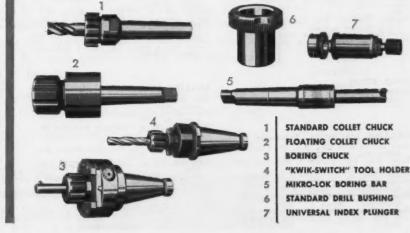
Universal Drill Bushings help increase efficiency and simplify jig drilling operations by insuring perfect alignment of drills. Blended radius on the top inside diameter guides the drill into place and helps prevent tool hang-up and breakage. Superfinish bores keep tool wear to a minimum, especially in close tolerance work. 100% concentricity and hardness tests insure accuracy and uniform high quality. Knurled heads provide a quick, sure grip. Made in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you-Universal Engineering Sales Co., 1060 Broad St., Newark 2, N.J.; 5035 Sixth Ave., Kenosha, Wis.-or our home office.



178

UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 2,

MICHIGAN



DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio. Barnes Drill Co., 814 Chestnut, Rockford, III. Buffalo Forge Co., 400 Broadway, Buffalo, N.Y. Buhr Mch. Teol Co., 835 Green St., Ann Arbor, Mich. Buhr Mich. Teol Co., 835 Green St., Ann Arbor, Mich.

Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.

Petra Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 4, Pa. Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., R. Y.

Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.

Govro-Nelson Co., Detroit 8, Mich.

Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

Moline Tool Co., 102 20th St., Moline, Ill.

Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.

Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

United States Drill Head Co., 616 Burns, Cincinnati, Ohio.

Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

BKILL HEADS, Unit Type
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet
St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee
St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Top & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester,
Mich. National Twist Drill & Tool Co., Rochester, Mich. Pratt & Whitney, West Hartford 1, Conn. Scully-Jones & Co., 1903 Rockwell St., Chicago 8, III. Union Twist Drill Co., Athol, Mass. Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio. Greenfield Tap & Die Corp., Greenfield, Mass. National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River
Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

DRILL STOPS

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

DRILLING MACHINES, Automatic

DRILLING MACHINES, Automatic
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros. Inc., Station F, P.O. Box 101,
Toledo 10, Ohlo.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St.,
Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave.,
Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor,
Mich.

Consolidated Mch. Tool Corp., Rochester, N.Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead
St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St.,
Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and
N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engra, Co., 3400 E. Lafayette,
Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd.,
Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch Co., 126 E. Third St.,
Covington, Ky.

Buffalo Forge Co., 490 Broadway, Buffalo.
Conedy-Otto Div., Cincinnati Lathe & Tool Co.,
Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.,
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Lelond-Gifford Co., 1025 Southbridge St.,
Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River
Rd., Cincinnati, Ohio.

DRILLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio. Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Gang

DRILLING MACHINES, Geng
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Boker Bros., Inc., Station F, P.O. Box 101,
Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, III.
Baush Machine Tool Co., 156 Wason Ave.,
Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave.,
Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Foodick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, III.
Leland-Gifford Co., 1025 Southbridge St.,
Worcester Mass.
Moline Tool Co., 102 20th St., Moline, III.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and
N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.

DRILLING MACHINES, Horix. Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich. Buhir Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St.,
Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machiner Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.

Millholland, W. K. Machinery Co., 6402 West-field Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and
N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, Ill.

DRILLING MACHINES, **Horizontal Portable**

Avey Drilling Mch. Co., 26 E. Third St., Cov-ington, Ky. Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avey Drilling Mch. Co., 26 E. Third St., Cov-Avey Drilling Mch. Co., 26 E. Inira St., Covington, Ky.
Boker Bros., Inc., Station F, P.O. Box 101,
Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, III.
Baush Machine Tool Co., 156 Wason Ave.,
Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and
N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky. Barnes Drill Co., 814 Chestnut, Rockford, III. Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Buhr Mch. 100 S., Mich. Mich. Mich. Cross Co., 3250 Bellevue, Detroit 7, Mich. Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F. P.O. Box 101,
Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St.
Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave.,
Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo,
N. Y.
Ruhr Mch. Tool Co. 835 Green St. Ann Ather. Boush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffelo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
On Mich. Tool Co., 835 Green St., Ann Arbor, Mich.
On Cakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Crosa Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St.,
Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pitrsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia
Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead
St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St.,
Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave.,
Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
Notional Automatic Tool Co., Inc., 954-M Harriet
St., Cincinnati 3, Ohio.
Notional Automatic Tool Co., Inc., 5, 7th and
N. Sts., Richmond, Ind.
Sty., Stehmond, Ind.
Sty., Suth Bend, Ind.
Suth Bend, Ind.
South Bend, Ind.
S

(Continued on page 336)



Quality, Service, Delivery

Over 62 years ...

PHILLIE

Helical
Spur Internal
Helical Internal
Rack
Herringbone
Worm
Non-Metallic
Splines
Coniflex Bevel
Spiral Bevel
Zerol
Hypoid
Intermittent
Sprockets

Outstanding, because every human and mechanical advantage in Gear making goes into their production: Experienced Designers, Trained Craftsmen, the most Modern Gear Cutting Machines, Up-to-the-minute Heat Treating Processes, Ever-watchful Inspectors, and Careful Shippers—all housed in Modern Buildings, and all under Management who have spent their lifetime in the Gear Business.

Add to these "Phillie Gear's" Courteous Service and Prompt Delivery, and you have a combination hard to beat . . . So, for Gears of any size or quantity, consult "Phillie Gear".

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK - PITTSBURGH - OHICAGO - HOUSTON - LYNCHBURG, VA.
Vicalia Gare & Machine Corp. Nephburg Va.



Industrial Gears & Speed Reducers

LimiTorque Valve Controls ESTABLISHED 1892

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-335

DRILLING MACHINES, Radial

DRILLING MACHINES, Redial
American Tool Works Co., Pearl and Eggleston
Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co.,
Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove
Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave.,
Cincinnati Bickford Tool Co., 3220 Forrer Ave.,
Cincinnati Gilbert Machine Tool Co., 3366
Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland,
Ohio.

Footi-Burt Co., 1300 St. Clair Ave., Clebeland, Ohio. Foadlick Mch. Tool Co., 1638 Blue Rock, Cin-cinnati 23, Ohio. Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich. Morris Mochine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio. Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y. Buffalo, Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
N. St., Richmond, Ind.
Nyerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend, Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

DRILLING MACHINES, Upright

DRILLING MACHINES, Upright
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101,
Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, III.
Barnes, W. F. & John, Co., 201 S. Water St.,
Rockford, III.
Baush Mch. Tool Co., 156 Wason Ave., Spring-field 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co.,
Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Farrer Ave.,
Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
Ediund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
8, Ohio. Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
8, Chio.
9, Chio., 1300 St. Clair Ave., Cleveland
8, Chio.
10, Chio., 1638 Blue Rock, Cincinnati 23, Chio.
Hartford, Special Mchry. Co., 287 Homestead
St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, III.
Leland-Gifford Co., 1025 Southbridge St.,
Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, III.
National Automatic Tool Co., Inc., S. 7th nad
N. Sts., Richmond, Ind.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee
St., Rockford, III.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St.,
Chicago 18, III.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind. DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio. Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS Center

DRILLS Center
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence S, R. i.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass. Keo Cutters, 19326 Woodward, Detroit, Mich. National Twist Drill & Tool Co., Rochester, Mich.

Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

DRILLS, Core

DRILLS, Core

Corboloy Dept., General Elecric Co., Box 237
Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich. 30, Pa.

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa., National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill., S., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich. Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich. Union Twist Drill Co., Athol, Mass. Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich. Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Prott & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Millers Falls Co., Greenfield, Mass. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati

DRILLS, Portable Pneumatic

Chicago, Pleamatte
Chicago Pneumatte Tool Co., 6 E. 44th St.,
New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 3940 Palmer St.,
Chicago, III.

DRILLS, Rachet

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong
Ave., Chicago, III.

Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester,
Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

DRILLS, Spade

Galring Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

DRILLS, Twist

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, III. Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio. DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Firth Sterling Inc., 3113 Forbes St., Pittsburgh DoAll Co., 2016
Firth Sterling Inc., 3113 Forces
30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester,
Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13,
Mich.
Athol. Mass. Super Tool Co., 21650 Hoover Rd., All Mass. Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Chicago-Latrobe Twist Drill Works, 411 W.
Ontario St., Chicago, III.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

DUPLICATORS

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis. Lehigh Foundries, Inc., 1500 Lehigh Dr., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr.,
Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St..
Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT General Electric Co., Schenectady 5, N. Y.

EMERY WHEEL DRESSERS See Dressers, Grinding Wheel

EMERY WHEELS See Grinding Wheels

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y. Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Drill

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio. Greenfield Top & Die Corp., Greenfield, Mass. Union Twist Drill Co., Athol, Mass. Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(Continued on page 338)

Bright ideas,,

The automotive industry is noted for its Bright Ideas...it uses felt in at least 82 different ways, because the right type of felt does those jobs best.



It's a Bright Idea to keep felt always in mind, for factory processes and equipment, and for finished products of all kinds. No matter what you make, or are designing, remember that felt can polish, seal, lubricate, control vibration and noise, act as a filter, do many other tasks with efficiency, economy and long life. American supplies felt of all types, in rolls, sheets, and parts cut to your dimensions, ready for assembly. If you will tell us what you make, we will-consult with you and provide technical information.



FACING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass.

FILES, Hand

Atkins Saw Div., Borg-Warner Corp., 402 S.
Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence,
R. I. R. I. Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass.

FILES, Machine

Atkins Saw Div., Borg-Warner Corp., 402 S.
Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Oliver Instrument Co., 1410 E. Maumee St.,
Adrian, Mich.

FILES AND BURS, Retary

Pratt & Whitney, West Hartford 1, Conn. Wesson Co., 1220 Woodward Heights Bivd.. Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS

Lowe Bros. Co., Dayton, Ohio. Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich. Ransburg Electro-Coating Corp., 1234 Barth, Indianapolis, Ind.

FLEXIBLE COUPLINGS

See Couplings, Flexible

FLEXIBLE SHAFT EQUIPMENT

Pratt & Whitney, West Hartford 1, Conn.

FORGINGS, Machines (Upsetting)

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio. Boldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa. Hill, Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

FORGINGS, Drop

Bethlehem Steen Co., Bethlehem, Pa. Mueller Bross Co., Port Huron 35, Mich. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored

Bethlehem Steel Co., Bethlehem, Pa. National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel

Bethlehem Steel Co., Bethlehem, Pa. National Forge & Ordnance Co., Irvine, Warren County, Pa.

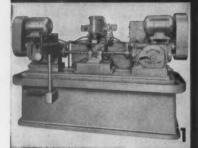
FORGINGS, Upset

Bethlehem Steel Co., Bethlehem, Pa. Mueller Brass Co., Port Huron 35, Mich. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati Milling Mch. Co., Oakley, Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave, N. S., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd.,
Chicago 36, Ill.
(Continued on page 340)

MILLHOLLAND



SPECIAL MACHINES

- for your special jobs

Millholland design gives you standard machine flexibility and economy . . . special purpose efficiency . . . and toolroom accuracy. The unique plate type cam, with pneumatic counterbalance used in Millholland Automatic Units, keeps units removing metal 80% of total cycle time. Millholland designs and builds a wide range of machines and fixtures to solve your special production and tooling problems. Let us show you how we can help you combine, speed up and simplify any combination of rotary tool operations.





- Many different parts are machined on this Double End Machine by changing fixtures, tools, V-belts and cams.
- 2. Milholland-designed fixtures enable this 12-station, 34-spindle vertical indexing machine to produce 93 pieces per hour.
- Design features permit this 4-staperform identical operations on two different steering gear housings without tooling

Write for More Information on These

W. K. MILLHOLLAND MACHINERY Co., Inc.

6402 Westfield Blvd., Indianapolis, Ind.

What's The Best Way To Gage These Parts?

Tips from Taft-Peirce on when and where to use a T-P CompAIRator Air Gage



Three ID's Tolerance: .120"

One three dial T-P CompAIRator Air Gage checks three ID's simultaneously on this asbestos cylinder. Only a T-P CompAIRator can check such wide tolerances. Versatile as well as sensitive, T-P CompAIRator equipment may be designed to check most any specific tolerance range from .0001" to .125". And most any dimension from simple ID's and OD's to complex tapers, barrel shapes, squareness or ovality.





Eleven ID's Tolerance: .001"

One eleven dial T-P Air Electric CompAIRator reduces inspection of 11 ID's on this valve body to a fraction of a second. Lights indicate any dimensions out of tolerance. Dials give exact readings of size. Savings in time alone paid for this unit in short order. Vibration, jarring, tilting won't disturb its accuracy.

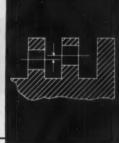




Concentricity Tolerance: .0002"

This T-P Computing CompAIRator indicates on one dial the total eccentricity between two diameters. Saves multiple measurements and a computation. An exclusive T-P development, Computing CompAIRators may also be used to speed and simplify such checks as center distance, taper, and squareness of bore-to-face.





For more examples and the complete story on Taft-Peirce CompAlRator Air Gages send for Bulletin.



WHAT IS A COMPAIRATOR AIR GAGE?

A CompAIRator is a sensitive gaging instrument that measures variations in the velocity of tiny jets of air. When work is placed over these jets, air flow is restricted and its velocity reduced. Any change in air velocity reflects a change in part size, which is immediately shown on a calibrated indicator. Since only air contacts the part in most cases, there is minimum wear on gaging members. Fast, accurate, dependable, a T-P CompAIRator is simple to operate, requires little or no maintenance.









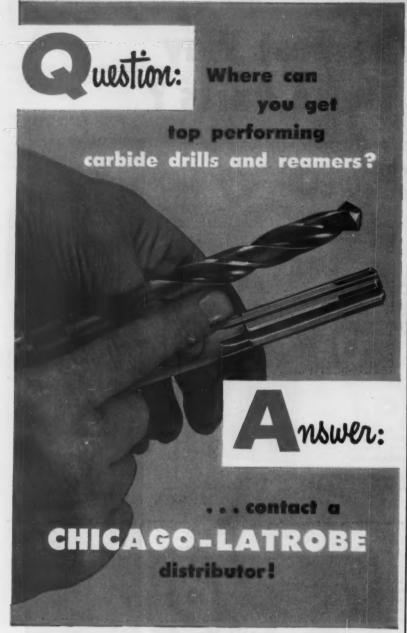
STANDARD AND SPECIA

COMPUTING

UTOMATIC SORTING

AIR ELECTRIC

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND



Chicago-Latrobe's vast plant is devoted exclusively to the making of fine drills, reamers, and kindred products. Chicago-Latrobe was one of the pioneers in the manufacture of carbide drills and reamers. This specialization results in the ability to make and deliver better tools. Specify Chicago-Latrobe and you'll see.

westion: How is Chicago-Latrobe service?

nower: Your CHICAGO-LATROBE Distributor gives you quickest service at lowest cost. Through him you get technical assistance, too!

Ask for Catalog No. 186



417 WEST ONTARIO STREET CHICAGO 10

Erie Foundry Co., Erie, Pa. Ferracute Machine Co., Bridgeton, N. J. Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III.

III.
Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES

FORMING AND STAMPING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engra. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves.,
Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd.,
Chicago 36, III.
Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. 1.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh
30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jeon
Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.

FRAMES, Machinery Welded

Mahon, R. H. Co., Detroit 34, Mich. Verson Allsteel Press Co., 93rd St. & S. Ken-wood Ave., Chicago, III.

FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.

FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I. DoAll Co., 254 Laurel Ave., Des Plaines, III. Pratt & Whitney, West Hartford 1, Conn. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Tatt-Peirce Mfg. Co., Woonsocket, R. I. Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator

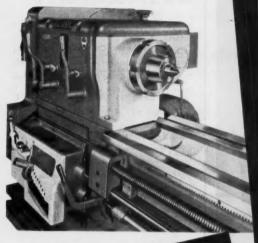
GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave.,
Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Lourel Ave., Des Plaines, III.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St.,
Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
(Continued on page 342)

double duty

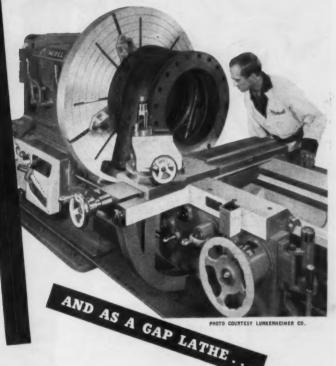


ebel gaplathes



AS AN ENGINE LATHE





Nebel lathes meet U.S. government standards

for Army, Navy, Air Force and atomic energy projects . . .

and have been approved by industry since 1889.

This big Nebel extension bed gap lathe outperforms two standard lathes. Yet it requires the floor space of just one lathe . . . and you make but one investment for this doubly useful, dual purpose lathe.

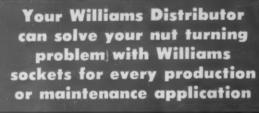
Nebel gap lathes made in two extension bed gap models: 28''/50'' (illustrated) and 20''/40''... and in removable block gap models.

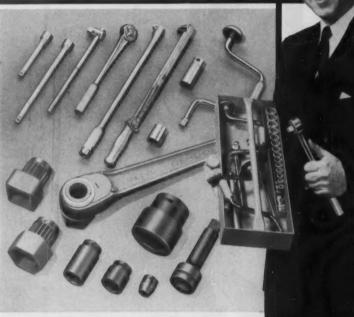


send for
descriptive bulletins

* THE NEBEL MACHINE TOOL CO.

3410 CENTRAL PARKWAY
CINCINNATI, OHIO





"SUPERSOCKETS", for Every Nut Turning Problem. 1/4, 3/8, 1/2, 3/4, 1" square drives. Openings from 3/16" to 3-1/8". Engineered flexibility permits hundreds of combinations of sockets, handles and

INDUSTRIAL SOCKETS for all types of power and Impact Wrenches. 1/4, 3/8, 1/2, 5/8, 3/4, 1 and 1-1/2" square drives. Single and double hexagon and square openings from 3/16 to 3-1/2". Over 550 sockets and accessories.

"SUPERRECTOR" Reversible Ratchet Handles and Sockets. 24, 36 and 48" length handles. Square sockets from 1 to 4-5/8". Hexagon sockets from 1-1/16 to 4-5/8". Sockets with thru-hole turn nuts on bolts of any length.

J. H. WILLIAMS & CO. 407 Vulcan Street . Buffalo 7, N.Y.



CARBON AND ALLOY STEEL WRENCHES . DETACHABLE SOCKETS AND DRIVERS • INDUSTRIAL IMPACT SOCKETS • TOOL HOLDERS • CUTTER BITS • LATHE DOGS • SET-UP TOOLS • "C" CLAMPS • THUMB NUTS AND SCREWS • HOIST HOOKS • EYE BOLTS • MACHINE HANDLES • ROD ENDS . CHAIN PIPE TONGS AND VISES . FLANGE-JACKS . PLIERS SCREW DRIVERS . HAMMERS . GEAR PULLERS . EXTRACTORS

WRITE FOR CATALOG 302 It includes the latest patterns and sizes from

quickest delivery at lowest cost!

You'll get SERVICE ON THE DOUBLE from your DISTRIBUTOR'S SALESMAN GAGES, Depth

GAGES, Depth

Ames, B. C., Co., (Dial), Waltham 54, Mass.

Brown & Sharpe Mfg. Co., Providence, R. I.

DoAll Co., 254 Laurel Ave., Des Plaines, III.

Federal Products Corp., P. O. Box 1027, Providence, R. I.

Harson-Whitney Co., Div., Whitney Chain Co.,

Hartford, Conn.

Lufkin Rule Co., Hess Ave., Saginaw, Mich.

Millers Falls Co., Greenfield, Mass.

Scherr, George, Co., Inc., 200 Lafayette St.,

New York 12, N. Y.

Sheffield Corp., 721 Springfield St., Dayton 1,

Ohio

Ohio Standard Gage Co., Inc., Poughkeepsie, N. Y. Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial

GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. 1.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Federal Products Corp., P. O. Box 1027, Providence, R. 1.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Latayette St.,
New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio Ohio Standard Gage Co., Inc., Poughkeepsie, N. Y. Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric

GACES, Electric
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DOAII Co., 254 Laurel Ave., Des Plaines, III.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GAGES, Height

GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.

Brown & Sharpe Mfg. Co., Providence, R. I.

Cleveland Instrument Co., 735 Carnegie Ave.,

Cleveland 15, Ohio.

DoAll Co., 254 Laurel Ave., Des Plaines, III.

Lufkin Rulle Co., Hess Ave., Soginaw, Mich.

Pratt & Whitney, West Hartford 1, Conn.

Scherr, George, Co., Inc., 200 Lafayette St.,

New York 12, N.

Sheffield Corp., 721 Springfield St., Dayton 1,

Ohio

Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap

GAGES, Plug, Ring and Snap
Axelson Mfg. Co., P. O. Box 15335, Vernon
Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237,
Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh
30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon
Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1,
Onio Sheffield Corp., 721 Springfield St., Dayton 1, Ohio Size Control Co., 2500 W. Washington Blvd., Chicago 12, II. Standard Gage Co., Inc., Poughkeepsie, N. Y. Starrett, The L. S., Co. Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I. Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass. Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GAGES, Surface

AGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland
Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Hanson-Whitney Co., Div. Whitney Chain Co.,
Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio. Ohio Starrett, The L. S., Co., Athel, Mass. (Continued on page 346)

ANGLE WRENCH with unmatched Torque Control



D'C.MOTOR



Canadian Division: Welland, Ontario

The most revolutionary new motor development in 40 years!



* •

R

I

V

E

Super'T'—the long-awaited answer to industry's demand for motors that meet the production requirements of today and tomorrow—the age of automation.

Reliance Super T'Line D-c. Motors are the result of a new approach to motor design providing higher commutating ability . . . lower mechanical inertia . . . and lower electrical inertia.

Super T'Line D-c. Motors do more in less time—provide Dynamic Response through controlled reaction to the demand for a change in speed or process. Operating as part of the V*S Drive, for instance, it is big and powerful enough to move heavy loads quickly . . . yet fully controllable and gentle enough so that it will not break, stretch, or tear material in process, regardless of gauge or composition.

Bulletin C-2002 will provide you with further details.
Call, wire or write your nearest Reliance District Sales

C-1491

Another of the Reliance Tools of Automation

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I. Pratt & Whitney, West Hartford 1, Conn. Sheffield Corp., 721 Springfield St., Dayton 1, Ohio Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.

DoAll Co., 254 Laurel Ave., Des Plaines, III. Federal Products Corp., P. O. Box 1027, Providence, R. 1.

Greenfield Tap & Die Corp., Greenfield, Mass. Pratt & Whitney, West Hartford 1, Conn. Sheffield Corp., 721 Springfield St., Dayton 1, Ohio Ohio Size Control Co., 2500 W. Washington Blvd., Chicago 12, III. Taft-Peirce Mfg. Co., Woonsocket, R. I.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago. Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y. Chicago Rawhide Mfg. Co., 1309 Elston Ave., Chicago, III, General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Spring-field, Vt. Gleason Works, 1000 University Ave., Roches-ter 3, N. Y. Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Gardan St., Philadelphia, Pa. Consolidated Mch. Tool Corp., Rochester, N. Y. Cross Co., 3250 Bellevue Ave., Detroit 7, Mich. Lipe-Rollway Corp., 806 Emerson Ave., Syra-cuse, N. Y. Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich. Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y. Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I. Eastman Kodak Co., Rochester, N. Y. Fellows Gear Shaper Co., 78 River St., Springfield, Vf. S., 1000 University Ave., Rochester 3, N. Y. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y. Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa. Gleason Works, 1000 University Ave., Roches-ter 3, N. Y. Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y. Waltham Machine Works, Newton St., Wal-tham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rock-Barber-Colman Co., Rock and Montague, Rockford, III.
Lees-Bradher Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd.,
Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut
Ave., Hillside, N. J.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St.,
New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn., Fellows Gear Shaper Co., 78 River St., Springfield, Vt., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich., National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Worm Wheels

Barber-Collman Co., Rock and Montague, Rockford, III.

Cone-Drive Gear Div., Michigan Tool Co., 7171

E. McNichols Rd., Detroit 12, Mich.

Fellows Geor Shoper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).

Lees-Bradner Co., Cleveland, Ohio

Michigan Tool Co., 7171 E. McNichols Rd.,

Detroit 12, Mich.

New Jersey Gear & Mfg. Co., 1470 Chestnut

Ave., Hillside, N. J.

Scherr, George Co., Inc., 200 Lafayette St.,

New York 12, N. Y.

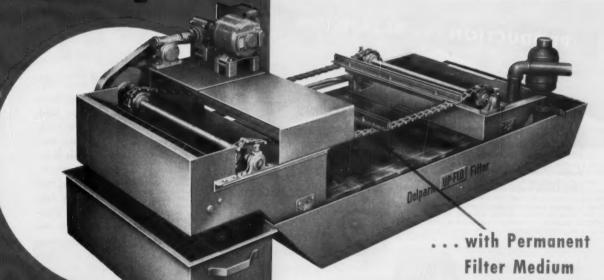
(Continued on page 348)



Industry required a 48-inch diameter Rotary Permanent Magnetic Chuck. O. S. Walker Company, Inc., Worcester, Mass. responded by designing and building this permanent chuck, the world's largest—and larger sizes are now available. Whatever your holding problems -magnetic or vacuum-Walker engineers have the answer. They are as close to you as your telephone-Worcester, Mass. PLeasant 6-6293.

Filters Fine Solids ...

UP-FLO FITCE



- FULL FLOW
- . HIGH EFFICIENCY
- . HIGH CAPACITY
- FULLY AUTOMATIC
- SELF CLEANING
- P BASIC GRAVITY PRINCIPLE

The Delpark Up-Flo Filter eliminates the need for disposable filter media. Now particles unbelievably small can be continuously filtered from all types of liquids without the efficiency of the filter being impaired. Heavier particles are removed by gravity and the upward flow of the liquid. Smaller fines held in suspension are removed by the permanent filter screen. The deposits are removed by automatically controlled flights which clean the fines from the permanent filter medium and at the same time remove the heavier deposits from the area below the screen. All material is deposited automatically in a tote box for disposal. Your Delpark field representative has the facts on this new development by Delpark engineering, producers of the finest in Industrial Filtration. Write today for more complete information.

Backed by more than 40 years experience in Industrial Filtration

National Tool Co., 11200 Madison Ave., Cleveland, Ohio. Pratt & Whitney, West Hartford 1, Conn. Van Norman Co., Springfield, Mass.

GEAR FINISHING MACHINES

GEAR GRINDING MACHINES

Fellows Gear Shaper Co., 78 River St., Spring-field, Vt. field, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd.,
Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean
Ave., Detroit 2, Mich.

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher
St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rachester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean
Ave., Detroit 2, Mich.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Spring-field, Vt. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Spring-field, Vt. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I. Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt., Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

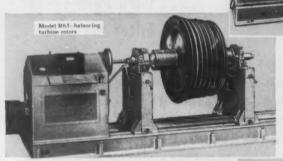
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave.,
Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring
Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North
Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8,
N. Y. Quincy, Mass.
Braum Gear Co., 239 Richmond, Brooklyn 8,
N. Y.
Chicago, Rowhide Mfg. Co., 1309 Elston Ave.,
Chicago, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St.,
Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200
E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave.,
Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave.,
Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead
St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez
Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd.,
Detroit 12, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut
Ave., Hillside, N. J.
Perkins Machine & Gear Co., West Springfield,
Mass.
Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Chicago Rawhide Mfg. Co., 1309 Elston Ave., Chicago, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
(Continued on page 350) (Continued on page 350)

PRODUCTION ... BALANCING WITH SCHENCK ELECTRO-DYNAMIC BALANCING MACHINES

Now, in a fraction of a minute and in a single run, you can accu Now, in a fraction of a minute and in a single rull, you can according to a single rull, you can accor uring system-without electronic tubes or oscillograph-that will indicate unbalances caused by displacements as little as 0.00004" from the center of gravity. Simple and easy to operate, the SCHENCK Balancer, by coordinate measurement, quickly indicates on a Wattmeter the unbalance of the rotating part.



The workpiece is balanced easily by adding or removing weight units at two of the four balancing points located within the coordinates, 90 degrees apart. For many production installations, Schenck Balancers combined with machine tools-check, correct and inspect parts in one set-up.

Model R33-balancing

Model R23-balancing

SCHENCK ELECTRO-DYNAMIC BALANCING MACHINES ARE THE RE-SULT OF 40 YEARS WORLD-WIDE EXPERIENCE. THEY ARE MADE IN MANY CAPACITIES TO BALANCE ROTATING PARTS WEIGHING UP TO 100 TONS.

Machine Type Measuring Range (Weight of part in lbs.) R13 R23 R33 R43 R53 1-22 3-66 1-220 3-660 11-2,200

Machine Type R43 R73 R83 R73 Measuring Range 33-6,600 110-22,000 330-66,000 1100-220,000 (Weight of part in lbs.)

Let Cosa Engineers recommend the proper Schenck Balancer for your needs. Or, send for detailed catalog.

nationwide sales and service of precision machine tools -from bench lathes to boring mills.

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.



Millions
of
operations
without
measurable
wear

NEW DENISON %" Solenoid Controlled— Pilot Operated Subplate Type 4-Way Valve for operating pressures up to 3000 psi

4 SPOOL TYPES – Provide all positioning arrangements required by most circuits.

SPOOLS POSITIONED 3 WAYS—With solenoid de-energized, spools may be spring offset, spring centered or without springs.

ADJUSTABLE PILOT CHOKES — Available if required for precise control of pilot flow to insure smooth, shockless reversal, time delay or sequence control.

PILOT PRESSURES TO 3000 PSI—Operated with pilot pressures from 50 psi to 3000 psi internally or externally without need for differential pistons.

INTERNAL OR EXTERNAL PILOT PRESSURE – May be internally or externally pilot operated and changed from one to the other in less than 2 minutes.

These SUPERIOR FEATURES in a valve likely INTERCHANGE-ABLE with that you are now using . . . but at a LOWER COST. Inquire about quantity discounts.

GET FULL FACTS. Specifications and description are in Bulletins VD-7 and VD-8.

THE DENISON ENGINEERING COMPANY

1244 Dublin Road . Columbus 16, Ohlo



PILOT OPERATED 4 WAY VALVE

CIRCUIT USING NEW

DENISON VALVE

CASE STUDY NO. 822-DV

PUMPS . MOTORS . CONTROLS

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y. Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio. Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I. Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y. N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129
Lockwood St., Newark S, N. J.
Sinclair Refining Co., 600 5th Ave., New York,
N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan,
Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y. Pratt & Whitney, West Hartford 1, Conn. Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDERS, Oilstone, for Woodworking

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Ingersoll-Rand Co., Phillipsburg, N. J. Madison-Kipp Corp., Madison, Wis. Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, III.

GRINDERS, Portable Electric and Toolpost

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Millers Falls Co., Greenfield, Mass. South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn. Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio. Mattison Mch. Works, Rockford, III. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio. Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

GRINDING MACHINES, Bench
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St.,
Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivette Lothe & Grinder, Inc., Brighton, Boston
35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River
Rd., Cincinnati, Ohio.
U. S. Burke Machine Tool Div., Brotherton Rd.
17, Cincinnati 27, Ohio.

GRINDING MACHINES, Broach

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich. Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa. Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich. Cosa Corp., 405 Lexington Ave., New York 17, N. Y. N. Y. Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. DoAll Co., 254 N. Laurel Ave., Des Plaines, -Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. (Continued on page 352)

The PROFILOMETER® METER can help you get 90% to 800% **MORE PIECES** PER GRIND

from cutting tools of every type!

WELL-KNOWN COMPANIES are getting 90% to 800% more pieces per grind - with important savings in production time, tool-sharpening time, and tool replacement cost. Here's how they do it:

In sharpening, they grind or lap the tool faces to a finish of 1 to 5 microinches. A difference of a few microinches can vitally affect performance; so they specify the microinch finish and measure it with the PROFILOMETER to make SURE. The Profilometer's versatility and dependable accuracy make it ideal for such work; and the savings obtained far outweigh the little time required to make such measurements.

FREE BULLETIN L22

gives case bistories of savings obtained - explains in detail all the benefits obtainable by smoothfinishing cutting tools. Want a copy? Write today!



Profilometer is a registered trade mark.

MANUFACTURING COMPANY

329 S. MAIN ST.

ANN ARBOR, MICHIGAN





"We depend on

Business Publications

for vital news

of a dozen industries..."

says E. J. Thomas, President
Goodyear Tire & Rubber Company, Inc.

"Alert reporting and expert interpretation of engineering and business news," Mr. Thomas adds, "make a variety of business periodicals 'must' reading for Goodyear executives."

Where editorial pages are "must" reading, advertising pages are studied, too. When the news and the articles of a magazine are essential and helpful to a reader, the facts and figures in the advertising pages impress him deeply.

Business publications provide a direct sales route for any product or service of benefit to business or professional men.

NATIONAL BUSINESS PUBLICATIONS, INC. 1001 Fifteenth Street, N. W., Washington 5, D. C. • STerling 3-7535

The national association of publishers of 171 technical, professional, scientific, industrial, merchandising and marketing magazines, having a combined circulation of 4,022,707 . . . audited by either the Audit Bureau of Circulations or Business Publications Audit of Circulation, Inc. . . . serving and promoting the Business Press of America . . . bringing thousands of pages of specialized know-how and advertising to the men who make

decisions in the businesses, industries, sciences and professions...pin-pointing the market of your choice.

Write for list of NBP publications and the latest "Here's How" booklet, "How Well Will We Have to Sell Tomorrow?", by Ralston B. Reid, Advertising & Sales Promotion Manager, Apparatus Sales Division, General Electric Company, Schenectady, N. Y.





Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich. Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y. Sheffield Carp., 721 Springfield St., Dayton 1, Ohio Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroil 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio. Heald Machine Co., 10 New Bond St., Worces-ter 6, Mass. Landis Tool Co., Waynesboro, Pa. Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Chucking

Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St.,
Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa. Lempco Products, Inc., 5490 Dunham Rd., Bed-ford, Ohio Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. Brown & Sharpe Mfg. Co., Providence, R. I. Cincinnati Grinders, Inc., Cincinnati, Ohio. Cosa Corp., 405 Lexington Ave., New York 17, N. Y. Landis Tool Co., Inc., Waynesboro, Pa. Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass. Mass. Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass. Sheffield Corp., 721 Springfield St., Dayton 1, Ohio. Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn. Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Lempco Products, Inc., 5490 Dunham Rd., Bed-ford, Ohio Mattison Machine Works, Rockford, III. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

GRINDING MACHINES, Drill

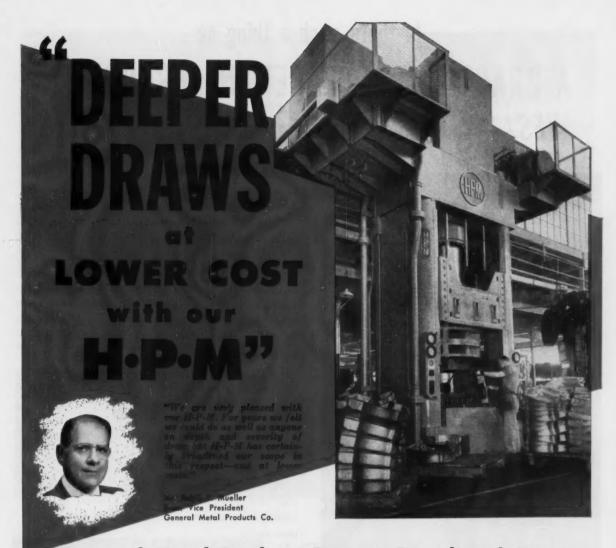
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Gollmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich. Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio ford, Orne Oliver Instrument Co., 1410 E. Madrian, Mich. Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y. Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Foce

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y. N. Y.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, III.
Oliver Instrument Co., 1410 E. Maumee St.,
Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment (Continued on page 356)



General Metal Products Reports Broadened Scope and Lower Costs with 700-ton H P M Hydraulic.

Take a tip from one of the midwest's largest metalworking specialists — H-P-M's will reduce costs for you, too. Whether it's drawing, forming, embossing, forging or other operations — large or small, deep or shallow, complex or simple — there's an H-P-M for the job. You'll find more and more work for

your H-P-M with its fast cycle, all-hydraulic, automatic control and ease of die set-up. If obsolete equipment is hampering your production, call in the H-P-M field engineer for a close look at the most modern press equipment available. Broaden your scope with faster, more versatile H-P-M's.

Write today for Bulletin 5005.



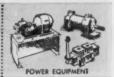






THE HYDRAULIC PRESS MFG. COMPANY
1042 Marion Road, Mount Gilead, Ohio, U. S. A.





Is there such a thing as...

A PRACTICAL REPLACEMENT PROGRAM?

YES! — and Jones & Lamson can help you develop it



Industry unanimously endorses the idea of planned replacement of capital equipment. Nevertheless, most of America's machine tools are more than 10 years old, sadly inferior to today's profit-producing equipment. The idea is sound — but action is lacking.

Biggest reason for this paradox is financial. Until recently, replacement required a substantial outlay of capital. In many cases, needed capital was lacking; in others, the capital, though available, had many other calls upon it. Unrealistically low depreciation allowances on capital equipment served as an added deterrent to replacement.

The picture has changed. Now, provisions of our new tax laws permit more equitable write-offs, and make replacement a more attractive proposition.

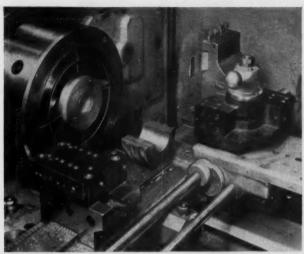
Jones & Lamson makes replacement even *more* feasible, by clearing away the traditional difficulties of financing with its unique Procurement Plans.

This, then, is what Jones & Lamson offers: modern machine tools that can greatly improve your production; plus your choice of several sound, low-cost (interest rates of 34%, and lower, add-on) methods of procuring these tools.

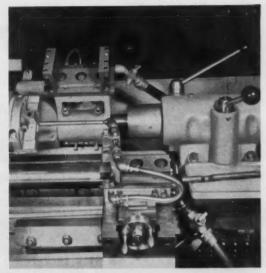
OBSOLETE machine tools like these hamper industrial growth, keep production low, and costs high.



RESEARCH in machining methods, metallurgy, tool geometry, is carried on continually by J&L. Important findings have resulted in the incorporation of unique engineering features in J&L machines.



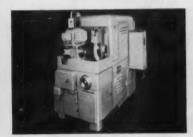
IMPROVED production on this difficult machining job was made possible by J& L engineers' close co-operation with the customer. Research testing, and incorporation of special features on a J& L turret lathe cut time-per-piece on this bottle neck-ring from 14 to 51/2 min., increased production 120%!



AUTOMATIC OPERATION. One Fay Automatic Lathe replaced eight engine lathes formerly used on this job - and substantially increased production of sewing machine crankshafts at the same time.



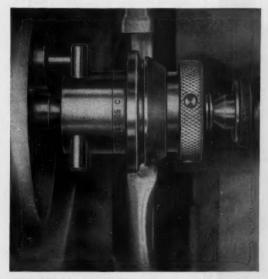
Universal Turret Lathes



Automatic Thread & Form Crinders



Fay Automatic Lathes



(0)

GRINDING. This J& L Model "E" Form Grinder, used in producing seaming rolls for the canning industry, completely eliminated a roughing operation, increased production by 100%.

JONES & LAMSON



MACHINE DE COMPANY

512 Clinton St., Springfield, Vt., U.S.A.

Universal Turret Lathes • Fay Automatic Lathes • Automatic Thread & Form Grinders
Optical Comparators • Automatic Opening Threading Dies & Chasers
Automatic Double-End Milling & Centering Machines

Send today for complete details on J & L's machines, methods and Procurement Plans. Simply fill in the coupon below, clip it to your letterhead and mail. We'll do the rest.

> JONES & LAMSON MACHINE COMPANY 512 Clinton St., Springfield, Vt., U. S. A.

GENTLEMEN:

Please send me the J& L Machine Tool Replacement Information Kit,

Name............

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio. Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.

Barber-Colman Co., Rock and Montague, Rock-Barber-Colman Co., Rock and Montague, Rockford, III.;
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York
17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

Gallmeyer & Livingston Co., 336 Straight Ave.,
S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St.,
Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6,
Mass.
Oliver Instrument Co., 1410 E. Maumee St.,
Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St.,
Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Standard Electrical Tool Co., 2488-90 River
Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St.,
Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

GRINDING MACHINES, Internal
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd.,
Worcester S, Mass.
Bryant Chucking Grinder Co., 257 Clinton St.,
Springfield, Vt.
Columbia Div., Lodge & Shipley Co., Hamilton
1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17,
N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit,
32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Rivett Lathe & Grinder Inc., Brighton, Boston
35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd.,
Cincinnati, Ohio.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shoor

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,

Ohio.
Mattison Machine Works, Rockford, III.
Standard Electrical Tool Co., 2488-90 River Rd.,
Cincinnati, Ohio.
United States Electrical Tool Div., Emerson
Elec. Mfg. Co., 1050 Findlay St., Cincinnati
14, Ohio.

GRINDING MACHINES, Piston Ring

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Heald Machine Co., 10 New Bond St., Worces-ter 6, Mass. Mattison Machine Works, Rockford, III. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

GRINDING MACHINES, Profile
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cleveland Grinding Machine Co., 1643 Eddy
Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Landis Tool Co., Waynesboro, Pa. Van Norman Co., Springfield, Mas (Continued on page 358)





SURFINDICATOR* QUICKLY PAYS FOR ITSELF through better surface finish control

THIS MODESTLY PRICED instrument permits you to measure surface roughness quickly, easily, surely—in the shop. With simple checks of surface finish you can:

- ...speed up inspection, avoiding costly delays and arguments.
- ... reduce machining costs by eliminating unnecessary overfinishing.
- ... meet specifications exactly.

The Surfindicator is portable, can be calibrated on the spot, can be operated by anyone. Surface roughness in microinches is indicated directly on the meter. The Surfindicator quickly pays for itself and helps you operate more efficiently. Send coupon today for complete information.

*Trade-Mork

BRUSH ELECTRONICS

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZOELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT AND COMPONENTS



COMPANY

Division of Clevite Corporation



In Development . . . Behr-Manning's laboratory evaluates coated abrasives by checking finish on test parts. Company reports, "Surfindicator has been most satisfactory"

Brush Electronics Company, Dept. D-3 3405 Perkins Avenue, Cleveland 14, Ohio.
☐ Please send free copy of "Surface Finish Control".
\square Have your nearest representative demonstrate the Surfindicator to me.
Name
Position

Address ______State _____

Company

GRINDING MACHINES, Rodial

Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.

GRINDING MACHINES, Radius, Link

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Mattison Machine Works, Rockford, III. Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd.,
Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati Milling Mch. Co., Oakley, Cincinnati Div., Lodge & Shipley Co., Hamilton 1, Ohio. nati y, Onio.

Columbia Div., Lodge & Shipley Co., Fichio.

1, Ohio.

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.

DoAll Co., 254 Laurel Ave., Des Plaines, III.

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich. Heald Machine Co., 10 New Bond St., Worces-ter 6, Mass. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Hill Acme Co., 1201 W. 68th St., Cleveland 2, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, III.
Norton Co., I New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17. N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St.,
Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Top

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St.,
Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro,
Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1,
Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio.
Norton Co., I New Bond St., Worcester 6,
Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt. Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Gardner Machine Co. (Surface Grinder), 414 E.
Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts.,
Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio. Ohio. Chambersburg Engrg. Co., Chambersburg, Pa. Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa. Erie Foundry Co., Erie, Pa. Lobdell United Co., 200 "G" St., Wilmington 99, Del. (Continued on page 360)

High Speed

CONTINUOUS OIL GROOVING

PIECES PER HOUR!

High-production and economical features of the WICACO CONTINUOUS OIL GROOVER . capable of completing as many as 500 grooved pieces per hour in routine practice—even with un-

The operator loads and unloads the work without stopping the Machine—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck

holds work to 4 1/2" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. write for detailed, wellillustrated Bulletin.



WICACO

SINCE 1868

THE WICACO MACHINE CORPORATION WAYNE JUNCTION

PHILADELPHIA 44, PA.

358—MACHINERY, March, 1955

For more information on products advertised, use Inquiry Card, page 257

TAKE A LOOK AT FARREL-SYKES ACCURACY



FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.),
Akron, Cleveland, Chicago, Los Angeles, Houston

Farrel-Birmingham

Besides precision, the "twin-head" gencrator gives you versatility, high production and convenient operation. It makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears, two members of a cluster gear simultaneously, and other toothed and cylindrical forms.

Write now for details of this accurate and versatile gear generator.

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-359

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa. Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Ingersoll-Rand Co., Phillipsburg, N. J.

HAMMERS, Portable Electric

Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa. Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

The "Smoothest

Propositions

on Earth"

CYLINDER

BORES HONED

with

FULMER HONING

MACHINES

HAMMERS, Shaft

Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa. Chicago Rawhide Mfg. Co., 1309 Elston Ave., Chicago, III.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave.,
Cleveland, Ohio.

EVEN so-called

"smooth as a mirror" finishing is "rough

stuff" compared to the A M A Z I N G L Y S-M-O-O-T-H AND

STRAIGHT bores of cylinders finished with

FULMER

HONING

MACHINES

Tolerances as

close as .0001 (\pm) . 15 sizes available for diameters from 1/4" to 30" and from 12" to 84" strokes.

OR ferrous and non-ierrous metals, glass, plastic, etc.

Photo taken in plant of F. & F. Koenigkramer Co., Cincinnati, Ohio, honing bores of hy-draulic cylinders.

> Write For Your Copy of our

> > bulletin on honing.

Cincinnati 2. Ohio

HARDENING MACHINES, Flome

Cincinnati Milling Machine Co., Cincinnati, Ohio. Gleason Works, 1000 University Ave., Roches-ter, N. Y.

HARDNESS TESTING INSTRUMENTS

Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa. Pa.
Scherr, George Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave.,
and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D
Park Ave., New York, N. Y.

HEADING MACHINES

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

.7

HOBS

Barber-Colman Co., Rock and Montague, Rock-Barber-Colman Co., Rock and Montague, Rockford, III.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd.,
Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Notional Twist Drill & Tool Co., Rochester,
Mich. Mich. New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J. Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Bethlehem Steel Co., Bethlehem, Pa. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Hydro-Line Mfg. Co., 5764 Pike Rd., Rock-ford, III. Ingersoll-Rand Co., Phillipsburg, N. J.

HOISTS, Chain, Etc.

Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

HOISTS, Electric

Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING MACHINES, External

Barnes Drill Co., 814 Chestnut, Rockford, Ill. Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)

(Cylinder)

Barnes Drill Co., 814 Chestnut, Rockford, Ill.

Barnes, W. F. & John, Co., 201 S. Water St.,
Rockford, Ill.
Fulmer, C., Allen, Co., 1231 First National Bank
Bldg., Cincinnati 2, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave.,
St. Louis 17, Mo.

(Continued on page 362)

360-MACHINERY, March, 1955

1231 First National Bank Bldg.

For more information on products advertised, use Inquiry Card, page 257



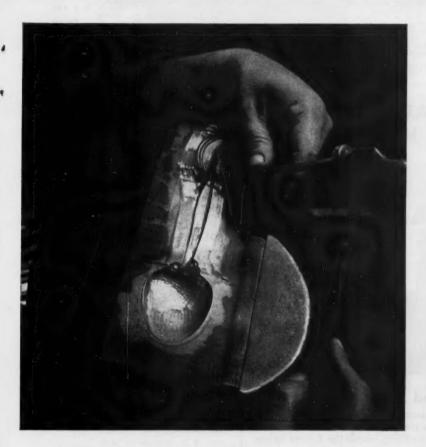
Tool Steel Topics



On the Pecific Court Bethlehem products are as

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Inguiry Distribution



Maker of Tableware Likes Economy of Striking Die of Bearcat

A maker of stainless steel tableware had been using striking dies which produced average runs of 19,000 pieces. Good, they thought, but perhaps by experimenting they could find something better. So they decided to switch to Bethlehem Bearcat Tool Steel, then watch their production figures. The number of pieces per die doubled, right from the start.

The Bearcat dies, used in working grade-rolled stainless blanks of varying thickness, are hardened to Rockwell C 56-58. As no redressing is possible, they are run until failure occurs. The shop superintendent says: "Bearcat is doing a phenomenal job. We particularly like its resistance to shock."

Besides shock-resistance, Bearcat is

well suited for any application where good machining is essential. It is deephardening in air, and offers low distortion in heat-treatment. For some applications, it can be carburized easily for long wear.

TYPICAL ANALYSIS

C	Mn	Si	Cr	Mo
0.50	0.70	0.25	3.25	1.40

In addition to its use for striking dies, Bearcat is also ideal for master hobs and engraving dies, used in related industries. You're sure to like Bearcat, no matter where you try it. Why not order a supply today from your local tool steel distributor, or from our well-stocked mill depot.

BETHLEHEM TOOL STEEL ENGINEER SAYS:



You Can Reduce Warpage by Supporting Tools During Heat-Treatment

Warpage of tools in heat-treatment is usually associated with the geometrical shape of the tools, or the manner in which they are supported during heating for the quench. When steels are heated in the critical range, just prior to quenching, they are weak, and if not supported properly, will sag or flow plastically.

Long tools should be supported at frequent intervals along their length. If section changes are present for appreciable lengths, the tools should be supported at each section. However, the span between supports should not exceed three times the tool diameter.



MAKE SHORT WORK OF STRIP STEEL

These knives, made of Bethlehem Lehigh S tool steel, are slitting cold-rolled strip steel to proper width, preparing it for a punch-press operation making sheetmetal parts. Lehigh S is our oil-hardening type of high-carbon, high-chromium tool steel. Its high hardness and maximum resistance to abrasion make it a steel with the ultimate in wear resistance.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, 111.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102' 20th St., Moline, III.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HONING TOOLS AND FIXTURES

Barnes Drill Co., 814 Chestnut, Rockford, III. Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio. Micromatic Hone Corp., 8100 Schoolcraft, De-troit 4, Mich. Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc. American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY Tools and equipment

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnoti, Ohio.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

III.
Barnes, John S., Corp., Rockford, III.
Barnes, John S., Corp., Berhlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta.,
Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus
16, Ohio.
Erie Foundry Co., Erie, Pa.

16, Ohio.

Erie Foundry Co., Erie, Pa.

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III.

Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.

Hydro-Line Mfg. Co., 5764 Pike Rd., Rock-ford, III. Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, III.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Modern Ind. Engrg. Co., 14230 Birwood Ave.,
Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee,
Rockford Mch. Tool Co., 2500 Kishwaukee St.,
Rockford, III.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, III.
Turchan Follower Machine Co., 8259 Livernois
& Alaska Aves., Detroit, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, III.
Vickers, Inc., 1402 Oakman Blvd., Detroit,
Mich.
Watson-Stillman, Co., Div., H. K. Porter Co.,
Inc., Roselle, N. J.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, III. Barnes, John S., Corp., Rockford, III. Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, III. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Honnifin Corp., 501 S. Wolf Rd., Des Plaines, III. Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio. Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis. Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

9

8

INDEXING AND SPACING EQUIPMENT

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Frown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati Ohio.
Hartford, Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, III.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Diel

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg, Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

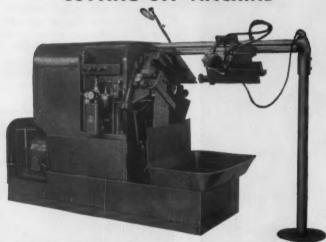
Brown & Sharpe Mfg. Co., Providence, R. I. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y. Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave.,
Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Micrometrical Mfg. Co. (Surface roughness & waviness), 321 S. Main St. Ann Arbor, Mich.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

(Continued on page 364)

The MODERN AUTOMATIC CUTTING-OFF MACHINE



Cuts Off Tubing, Pipe and Shafting . . . FAST

Cuts off longer pieces than a regular automatic machine. In fact, cuts off any length you want-and cuts it faster. If your production requires quantity cutting-off of tubing, pipe or shafting, check the figures below against your present time.

1/2" Tubing

1 1/4" Cold Rolled

1" Tubing

This machine cuts off and chamfers both outside edges of ½" .030 wall tubing, 5" long, at the rate of one every 2.5 seconds.

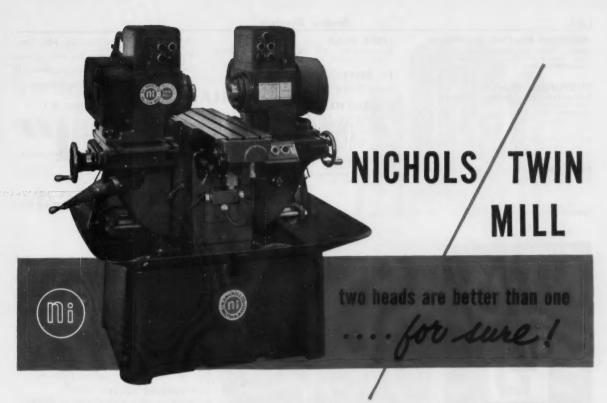
This machine cuts off and chamfers both ends of 11/4" cold rolled, 20" long, at the rate of one every 20 seconds.

This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

These popular, time saving machines are now available in four sizes, handling work up to 63/4" O.D. Their many cost cutting features are described and illustrated in our latest catalog that will be mailed promptly on request.

WRITE FOR ILLUSTRATED CATALOG.

MODERN MACHINE TOOL CO. Jackson, Michigan



The Nichols Twin Mill is something new in duplex millers — a precision 2-spindle bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces, using horizontal or vertical spindles.

The Twin Mill provides unmatched flexibility! It is equally adaptable for long-run or short-run jobs. The two geared milling heads are independent units, with separate 1 HP motor drives, and are quickly adjusted either directly opposed or offset longitudinally, vertically or transversely. Set-up is fast and simple.

The wide range of spindle speeds from 55 to 2050 R.P.M. allows milling of ferrous or non-ferrous materials with high speed or carbide tipped cutters, producing EXTRA FINE FINISH while maintaining the closest tolerances with ease.

The Twin Mill is completely push-button controlled, arranged for automatic table cycling — with rapid approach, hydraulically controlled variable cutting feed and rapid return. Available with automatic retraction of milling heads, automatic spindle brakes and carefully engineered special features to meet specific applications.

The parts shown are typical of those on which the Twin Mill is cutting costs `and boosting production. Investigate the savings it can make for you. For details write to Nichols-Morris Corporation.

CONDENSED SPECIFICATIONS

Table, working surface	8%" x 30"
Table Travel - cutting stroke	11%"
Motors	(two) 1 HP
Spindle Speeds (15) from 55	to 2050 RPM
Max. height center of spindle above table	11%"
Max. offset of spindles thorizonte	al) 835"
Max. distance between spindle noses (across table)	16"
Floor space required	64" x 56"



Manufactured by W. H. Nichols Company, 48 Woerd Avenue, Waltham 54, Mass.



INDUCTION HEATING EQUIPMENT

General Electric Co., Schenectady, N. Y. Ohlo Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

JACKS, Machine Leveling

Enterprise Mch. Parts Corp., Detroit, Mich.

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

HG BORER

See Boring Machines, Jig

JIGS AND FIXTURES

Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Com.
Heuser Mfg. Co., 1638 N. Paulina St., Chicago,
III. III.
Ingersoll Milling Machine Co., 2442 Douglas
St., Rockford, III.
Logansport Machine Co., Inc., 810 Center Ave.,
Logansport, Ind.

Millholland, W. K., Machinery Co., 6402 West-field Blvd., Indianapolis 5, Ind. National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich. Sheffield Corp., 721 Springfield St., Dayton 1, Ohio Ohio Co., 435 Eastern Ave., Bellwood, III. Snow Mfg. Co., 435 Eastern Ave., Bellwood, III. Sundstrand Machine Tool Co., 2531 11th St., Rockford, III. Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS

See Fittings, Hydraulic, Pneumatic,

KEYS, Woodruff, Machine, Special

Standard Automotive Parts Co., 660-668 Nims St., Muskegon, Mich.

KEYSEATERS

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio. Consolidated Mch. Tool Co., Rochester, N. Y. Davis Keyseater Co., 405 Exchange St., Roches-ter 8, N. Y. Lapointe Machine Hudson, Mass. Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS

Brown & Sharpe Mfg. Co., Providence, R. I. Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Pratt & Whitney, West Hartford 1, Conn. Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

LAPPING MACHINES

Barnes Drill Co. (Straight Line or Rotating),
814 Chestnut St., Rockford, III.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, III. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Notton Co., 1 New Bond St., Worcester 6, Mass. Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago. Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, III. Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.

Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

Jones & Lamson Mch., 160 Clinton St., Springfield, Vt., Ind., 107 N. Franklin Ave., Syracuse 4, N. Y.

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

(Continued on page 368) (Continued on page 368)





The rigidity-versatility-accuracy of this new press enable it to produce more at lower costs. It provides a new concept of efficient press operation.

The air clutch is standard equipment on both geared and non-geared models. This provides easier and safer means for maximum practical speeds with shock-free, full-power operation. Alloy iron frame, long adjustable gibs, recessed crankshaft bearing caps, large air release-spring set brake and rugged ram adjusting screw with buttress thread and replaceable bronze seat are but a few of the features that will help to better your press operations.

Specifications

Capacity-90 tons. Standard Stroke-4", Maximum Stroke (to order)-8". Strokes per minute-40 (non-geared type 70). Throat Depth center of ram to frame-121/2". Die Space-161/2" to 24" (bed to ram, stroke down, adjustment up). Bolster Plate Area-38" x 24".



Write for Catalog-Fully describes all L&J O.B.I. Presses-21 geared and non-geared models. Capacities 8 to 90 tons. Also, 20 to 50 ton High Speed, Double Crank Straight Side Presses with speeds up to 450 s.p.m. Ask for Catalog L-12.

L & J Press Corporation, 1631 Sterling Ave., Elkhart, Ind.

THEY SAID:

'IMPOSSIB

This special Lempco Press made the job routine!

This special Shell Forging Press, designed and built by Lempco made a routine job of a shell forging operation that was thought "impossible" to produce on any press. Because of the high speed of ram travel -840 inches per minute - that Lempco built into this big 400 ton press, production is up to 80 shells per minute on an assembly line basis.

In building presses for special applications, Lempco refuses to label any job "impossible". Lempco engineers call on a background of 35 years experience to reduce your problems to routine by customizing presses - big or small that perform with satisfaction for every job requirement.

Why not put this experience to work when you have a pressing problem that requires specialized design and engineering! Just let Lempco know your requirements they'll take over from there. Lempco engineering service endeavors to answer all inquiries within 48 hours.

THESE IMPRESSIVE OPERATING STATISTICS MATCH THE IMPRESSIVE SIZE OF THIS CUSTOMIZED SHELL FORGING PRESS

- Capacity 400 tons
- Height 22 ft. (16' above foundation)
- Width 64"
- Depth 94"
- Cylinder − 20" dia. − 2500 p.s.i.
 Motor − 400 h.p.
- Max. Pressing Speed 840 inches per minute (with Accumulator)
 Max. Pressing Speed 160 inches per minute (with Pump only)



FRANK VASARHELY Chief Tool Engineer Designer of Press

• Reservoir Capacity - 2200 gal Accumulator — 600 gal.

● Pump - 220 g.p.m.

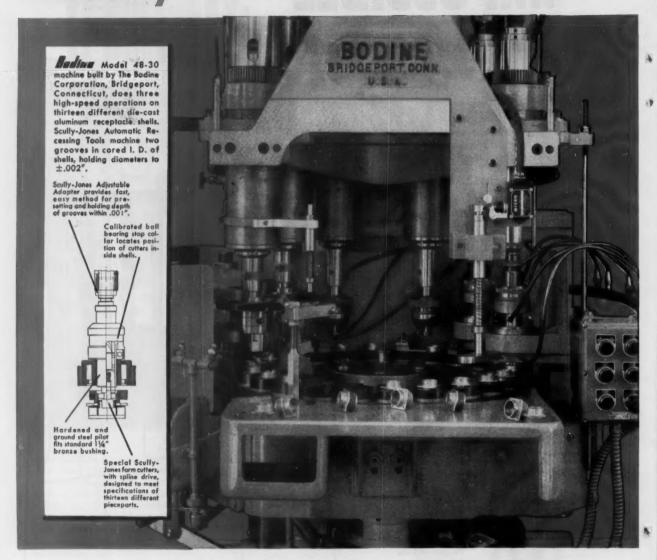
INDUSTRIAL DIVISION

OHIO, U.S.A.

Builder of Machine Tools Leading

SCULLY JONES

Recessing Tools provide for internal grooving...



Bodine Model 48-30 "factory-equipped" with Scully-Jones Automatic Recessing Tools

Bodine dial-type machines are easily tooled for a variety of high speed operations, permitting special-purpose machine economies, with minimum capital investment. This "Model 48-30," for example, machines grooves, O.D., and threads of thirteen different receptacle shells at rates from 1600 to 2200 per 50-minute hour. Scully-Jones Type "J" and "C" Automatic Recessing Tools simplify intricate internal grooving operations and provide fast, accurate adjustments necessary for handling a wide range of work.

versatile and low-cost method production, 1600 to 2200 per hour!



Micrometer Grinding Fixture

Provides accurate method for quickly sharpening and measuring circular form tools. Insert and use without need to cut-and-try. Bulletin No. 21-50.

Want to do intricate, internal machining operations on standard drill presses, radial drills, turret lathes, or chucking machines... and reduce costs? You can get high production and hold close tolerances on your chamfering, grooving, relieving, back-facing, counterboring, necking, and boring operations using Scully-Jones Automatic Recessing Tools. In fact, by changing a tool bit holder or circular form cutter, a single recessing tool is easily and quickly adapted to do all, or a combination of these operations on standard machine tools!

Scully-Jones Recessing Tools reduce costs because many manual operations and skill requirements are eliminated. Positioning of the cutting tool and depth of cut are automatically controlled. Initial adjustments are simple, fast, and accurate. And properly adjusted, these low-cost tools will give you consistent accuracy and trouble-free performance on long run jobs.

Let your factory-trained Scully-Jones representative or distributor show you how automatic recessing tools can do many jobs well ... at lower cost! Ask for Bulletin No. 10-50.



SCULLY-JONES

"Precision Holding" for holding precision
Scully-Jones and Company, 1906 S. Rockwell Street, Chicago 8, Illinois

Compression Fixture and Setting Gage

These two new Scully-Jones fixtures provide quick, accurate method for pre-setting recessing tools for location and diameter of undercut.

Compression fixture holds recessing tool in position, frees operator for adjusting stop collars and using feeler gage. Feeler gage is made special to fit your specific job requirements. Bulletin No. 21-50.



Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Praft & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Moss.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernols & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES. Automatic

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 56, Cal. Baird Machine Co., 1700 Stratford Ave., Strat-ford, Copp.

Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave.,
Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight
Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St.
Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave.,
Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley
Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave.,
Pawtucket, R. I.

Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y. LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio. Seneca Falls Mch. Co., Seneca Falls, N. Y. Sryder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y. N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston
35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox
Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind. 4

19

LATHES, Boring

LATHES, Boring

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta.,
Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton
Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave.,
Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y. LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio. Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal. H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y. Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich. Lodge & Shipley Co., 3055 Colerain Ave., Cin-cinnati 25, Ohio. Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio. Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Ayes., Cincinnati, Ohio.

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Sta., Los Angeles 58, Calif.

Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

(Continued on page 370) (Continued on page 370)



BUILT to Turn out

Sheldon Lathes are designed and built to do accurate lathe work rapidly and profitably. Moderate in price they have the collet, swing and power capacity to de most toolroom work.

Design

Features: Large and wide "Zero Precision"Tapered Roller Spindle Bearings-permit operation at all speeds, retain accuracy, end expensive bearing maintenance costs.

• 54-pitch Gear Bex—gives both standard and many hard to get thread ratios. Large Micrometer Dials—Make accur-

ate operation easier. • Extra Collet Capacity - 1%" hole through spindles available on 10", 11" and 13" swing lathes.

More Power to Spindle-Efficient drives with bigger meters and double neoprene cog V-belts to

spindle.



collet attachments, and other production and toolroom accessories. Lathes available with a choice of "Bench," "Cabinet" or "Pedestal" mountings. Write for New Catalog G-55

OPTIONAL FEATURES

AT EXTRA COST

include: Hardened ways, Long Tapered Key Drive Spindles, 4"

D1 Camlock Spindles bed turrets,

UMS6P 13" Swing Lathe 34" Between Centers Ropid Shifting "U" Drive

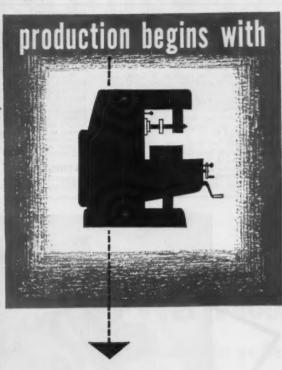
MACHINE CO., Inc.

4246 N. Knox Ave.

Chicago 41, Illinois

See our display at the Western Metal Show, Booth 614





Columbus Die-Tool

No tools like the right tools! Columbus Die-Tool designs and builds tools, jigs, fixtures and special machinery to meet your most exacting requirements. RESULTS: operating cost that matches your budget; production that matches your schedule; product quality that matches the demands of your market.

Contact Columbus Die-Tool & Machine Co. first—when you have a special machine problem. They are nationally known as expert designers and builders of special machinery and equipment . . . have been for over 46 years.



ERRINGTON Mechanical Laboratory, Inc.

Main Office and Plant STATEN ISLAND 4, NEW YORK

aluminum case and cover.

Hardened and ground spindles. Gears turned on spindles (not pinned on). Heavy duty grooved ball thrust bearings all enclosed in a sand cast

Send For Complete Information

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25. Ohio.

Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.

Ohio.

Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.

Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

Pratt & Whitney, West Hartford 1, Conn.

Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, III.

Seneca Falls Mch. Co., Seneca Falls, N. Y. Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, III. Sidney Machine Tool Co., Sidney, Ohio.

Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

LATHES, Gap

Axelson Mfg, Co., P.O. Box 15335, Vernon Sta., Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholf Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Folls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Sta. Los Angeles 58, Cal.

Consolidated Mch. Tool Corp., Rochester, N. Y. LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio. Seneca Falls Mch. Co., Seneca Falls, N. Y. Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle

LATMES, Hollow Spindle
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta.,
Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and
Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind.

LATHES, Manufacturing Type

Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich. Lipe-Rollway Corp., 806 Emerson Ave., Syra-cuse, N. Viey Co., 3055 Colerain Ave., Cin-cinnati 25, Ohio.

日夢

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio. Ohio. Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom

LATHES, Turret

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17,
Gistolt Maghine Co. 1245

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cobinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn. Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6. Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn. Lufkin Rule Co., Hess Ave., Soginaw, Mich. Millers Falls Co., Greenfield, Mass. Pratt & Whitney, West Hartford 1, Conn. Starrett, The L. S., Co., Athol, Mass. Taff-Peirce Mfg. Co., Woonsocket, R. I. (Continued on page 372)



Yes, when your production gears need deburring and chamfering your answer is a Burr-Master. Capable of chamfering the entire tooth form and root, Burr-Masters are available in a wide range of models to meet every need.

No matter what the length of your production runs or the size gears to be chamfered, the Universal Burr-Master (shown) holds the answer to many of your finishing problems. The newest member of the Burr-Master line, it handles both spur and helical gears as well as straight and involute form external splines.

Complete details in Bulletin 103-60. Ask for it.

*Reg. Pat. Pending

DETROIT 38 MICHIGAN Industrial Engineering Co.

HERE IS YOUR NEW 15TH EDITION

MACHINERY'S HANDBOOK
has been the indispensable reference work for designers and builders of
mechanical products. Now the new 15th Edition
gives you the most authoritative information
on present-day designing, manufacturing
and metalworking practices.

Have you ordered your copy?
Send for MACHINERY'S HAND-BOOK under our Five-Day Free Inspection Plan. Examine it; study it; use it . . . and if you are not convinced that it is the most useful, convenient and comprehensive handbook you have ever seen, you may return it without any obligation. Use the convenient coupon to order your copy of MACHINERY'S HANDBOOK today.

MACHINERY HANDBOOK

This offer applies in U. S. only. See coupon for Canadian or overseas offers.

1911 PAGES \$9.00 POSTPAID IN U.S.

THE INDUSTRIAL PRESS, 93 WORTH ST., NEW YORK 13, N. Y.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

Cities Service Oil Co., 70 Pine St., New York, N. Y. Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120
Lockwood St., Newark S, N. J.
Shear-Speed Chem. Prod. Div., Michigan Tool
Co., 7125 E. McNichols Rd., Detroil 12, Mich.
Sinclair Refining Co., 600 5th Ave., New
York, N. Y.
Socony Vacuum Oil Co., Inc., 26 Broadway,
New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan,
Chicago, Ill.
Stuart, D. A. Oil Co., Ltd., 2739 S. Tray St.,
Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

DO IT

YOURSELF!

STANDARD

and/or

Feeds or Traverse .

Precision Spindle

Work Head . . .

Assemble with STANDARD

To convert your

To design your own assembly or

old machine tool ...

LUBRICATING SYSTEMS
Farval Corp., 3249 E. 80th St., Cleveland, Ohio.

PRECISION

Machine Tool Attachments

TRAVERSE SLIDES FEEDS TABLES

SPINDLES-MOTORIZED OR BELT DRIVE FOR WORK HEAD OR GRINDING WHEEL

8"x21"

Precision

(Tilting)

Special

Mounting

Base

Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St.,
Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St.,
Chicago, Ill,
Rivett Lathe & Grinder, Inc., Brighton, Boston
35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MAGNETIC BASES FOR INDICATORS

du Mont Corp., Greenfield, Mass.

Swivel

Compound Feed

Graduated

Swivel Base

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago. DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich. Mox Wyler, 611 W. 43rd St., New York 36, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Prott & Whitney, West Hartford 1, Conn. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

15

¥

+

Ohio Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I. Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Taft-Peirce Mfg. Co., Woonsocket, R. I. Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.,

METAL FINISHINGS

Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

METERS

See Recording Instruments

MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass. Brown & Sharpe Mfg. Co., Providence, R. I. DoAll Co., 254 N. Laurel Ave., Des Plaines, III. Lufkin Rule Co., Hess Ave., Saginaw, Mich. Millers Falls Co., Greenfield, Mass. Pratt & Whitney, West Hartford I, Conn. Scherr, George, Co. Inc., 200 Lafayette St., New York 12, N. Y. Starrett, The L. S., Co., Athol, Mass. Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmokers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Brown & Sharpe Mfg., Co., Providence, R. I. Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Prott & Whitney, West Hartford I, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.
(Continued on page 374) (Continued on page 374)

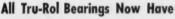


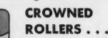
ROLLWAY

Tru.

ROLLER BEARINGS

...up-to-the minute design...
plus economy











COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARING

• Proved in performance . . . proved for economy . . . unsurpassed for versatility . . . the Tru-Rol Bearing incorporates the design know-how accumulated through Rollway's many years of experience with all types of cylindrical roller bearings. Tru-Rol's features result in adaptability for any application requiring just the right balance between precision and economy.

• Designed for Versatility: Tru-Rol is available in all the inner and outer race combinations demanded by today's design. Crowned cylindrical rollers eliminate end loading—assure a uniform stress pattern along the full length of each roller, and prolong bearing life. Tru-Rol versatility offers a choice of stamped steel retainers with guide lips, or steel segmented retainers . . . both providing perfect alignment for every roller. These features have been quick to gain favor with engineers, and have led to the selection of Tru-Rol Bearings for a broad variety of applications.

Free! New Catalog...

36 pages of Valuable Information—Mail Coupon Today. The Tru-Rol Catalog includes all required data on every size, every type of Tru-Rol Bearings; complete description, ratings, dimensions—plus extra copies of the new Quick-Calculating Alignment Chart . . . a graphic solution of the *RBEC formula for bearing selection.

*Roller Bearing Engineers' Comm .- Anti-Friction Bearing Migs. Assn

ROLLWAY BEARING CO., INC. 551 Seymour St. • Syracuse 4, N. Y.

Please forward free copy of your new Tru-Rol Catalog with extra Alignment Charts.

Name_____Title____

Firm Name_____

Address.

ENGINEERING OFFICES: Syracuse · Boston · Chicago · Detroit · Toronto · Pittsburgh · Claveland · Milwaukee · Scattle · Houston · Philadelphia · Los Angeles · Sen Francisco

For more information on products advertised, use Inquiry Card, page 257

MACHINERY, March, 1955-373

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis. Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio. Consolidated Machine Tool Corp., Rochester, N. Y. N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, III.
Jones & Lamson Mch. Co., 160 Clinton St.,
Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Milholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.

Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill. U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.-Pratt & Whitney, West Hartford 1, Conn. U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y. Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis. Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.

Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill. Kearney & Trecker Corp., Milwaukee, Wis. Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y. Espen-Lucas Mch. Works, Front St., and Girard Ave., Philodelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

MILLING MACHINES, Hand
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave.,
White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd.,
Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield
7, Mass.

1

MILLING MACHINES, Horizontal, Plain and Universal

and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lime-Hamilton Corp., Lima Hamilton, Div., Hamilton, Ohio.

Frown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.

Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford I, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield, 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I. Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

MILLING MACHINES, Planer Type
Baldwin-Lima-Hamilton Corp., Lima Hamilton,
Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard,
Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du,
Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn.
R. R., Evanston, Cincinnati, Ohio.
Ingersoli Milling Mch. Co. 2442 Douglas St.,
Rockford, Ill.,
Rearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit.
32, Mich.

(Continued on page 376)



...a Reality with TINIUS OLSEN Elecadyne Balancing

Machines

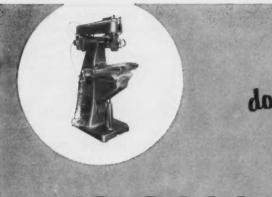
To meet a pressing need in the automotive industry, Olsen developed a machine for removing unbalance from crankshafts automatically. Unbalance readings are "memorized" by the machine and material is removed automatically with high speed drills. As many as 24 or more crankshafts per hour are being balanced and corrected within 0.3 ounceinches on a production line basis, with no operator judgment

Any mass-produced rotating part can be balanced automatically by applying the versatile functions of the Olsen Elecodyne principle to the specific requirements of the product. An experienced Olsen balancing engineer will gladly discuss your balancing needs in terms of the significant savings, consistent accuracy and production speed inherent in Olsen automatic balancing equipment.

Write for a copy of Olsen Bulletin 49



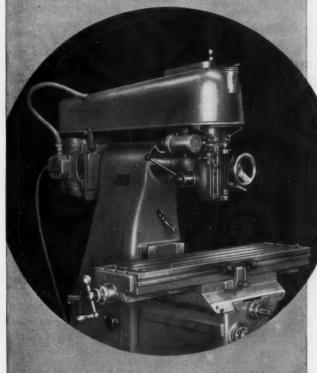
TINIUS OLSEN TESTING MACHINE CO. 2080 Easton Road - Willow Grove, Pa. **Testing & Balancing Machines**



does MORE work... MORE easily

new POWER FEED HEAD

U. S. Vertical Miller



Write for descriptive folder

Here's the new U. S. Vertical Miller with Power Feed Head - the head into which U. S. has built all the most wanted features without sacrificing traditional U. S. simplicity. Check its infinitely variable feed rate, its 800 pounds of down thrust on the quill, its supplemental hand feeds - it is the milling head that was designed to meet all shop needs.

Add to these the basic advantages of the U.S. Vertical Miller. You can easily see why it's the milling machine that "does more work more easily."

Detailed literature on request. The U.S. Burke Machine Tool Division. 17 Brotherton Road, Cincinnati 27, Ohio.

more versatile

Feed infinitely variable from .002" to .008" while in operation

greater capacity

5½" power quill travel; 800 lb. down thrust

more convenient

Supplemental hand feeds

increased rigidity

Enclosed hard chrome plated quill with

U * S * Burke MACHINE TOOL DIVISION

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.

MILLING MACHINES, Ram Type Universal

Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type Bridgeport Machines, Inc., Linley Ave., Bridge-port, Conn.

MILLING MACHINES, Vertical

MILLING MACHINES, Vertical
Boldwin-Lima-Hamilton Corp., Lima Hamilton
Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati,
Ohio.
Corsolidated Machine Toll Corp., Rochester
N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave.,
Rockford, Ill.
Gorton, Geo., Mch., Co., 1110 W. 13th St.,
Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Pratt & Whitney, West Hartford I, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette,
Detroit T, Mich.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27,
Ohio.



See Special Machinery and Tools

MOLD AND DIE COPYING MACHINES

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic

American Steel Foundries, Flass Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-nati, Ohio. Erie Foundry Co., Erie, Pa. Hannifin Corp., 501 S. Wolf Rd., Des Plaines,

III.
Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee
St., Rockford, III.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, III.
Vatson-Stillman Co., Div., H. K. Porter Co.,
Inc., Roselle, N. J.

.

X

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio. General Electric Co., Schenectady, N. Y. Howell Electric Motor Co., Howell, Mich. Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic

Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis. Sundstrand Machine Tool Co., 2531 11th St., Rockford, III.

MULTIPLE-SLIDE FORMING MACHINES

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

International Nickel Co., Inc., 67 Wall St., New York, N. Y. Wales-Strippet Corp., North Tonawanda, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery,

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, III.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, III.

NUTS, Thumb or Wing and Cap

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only). Williams, J. H., & Co., 400 Vulcan St., Buffalo Illiams, J. H., & Cb., 400 Vulcan St., Buffalo 7, N. Y. (Continued on page 378)



Give this versatile head the nod and save time and money these seven ways:

- 1. You can use cup wheels for practically all clearance angles and thus produce a cutting edge on tools that lasts longer because it is stronger.
- 2. You can keep the tooth rest on the center line of the cutter for practically all grinding on centers or in the work head.
- 3. You can grind most cutters and reamers all over with a single set-up using the swivelling table and Pope tilting head.
- You can read all clearance angles directly in degrees from the scale provided on the head. No more mistakes.
- 5. You can get the right clearance angle on such tough grinding jobs as slab mills, taper reamers, angular cutters and form tools.

- 6. You have one safe speed 3600 RPM for all wheels generally used on cutter grinders. Heat checking of cutters is virtually elimi-
- You have a head that's so easy to adjust and use it saves you time and money every time you grind a tool.



Ask us to sub ing price and delivery. No. 101

POPE MACHINERY CORPORATION

261 RIVER STREET . HAVERHILL, MASSACHUSETYS

PRECISION SPINDLES



MACHINERY'S HANDBOOK-In this indispensable reference book of the mechanical industries are 248 pages of information on gears of all types. Included are new data and formulas for proportioning, machining, and inspecting fine-pitch gears, bevel gears, and worm gears. 1911 pages, thumb in-\$9.00

Postpaid in U. S. In Canada or overseas, \$9.90

ENGINEERING ENCYCLOPEDIA—Condensed and practical information on mechanical laws, rules and principles; physical prop-erties of materials; features and functions of machine tools, and many other subjects. Two volumes, 1431 pages, 206 drawings. \$10.00

Postpaid in U. S. In Canada or overseas, \$11.33

MATHEMATICS AT WORK-A comprehensive problem-solving guide written especially to show how arithmetic, algebra, geometry, trigonometry and logarithms are

applied to the metalworking field. Covers many gear problems including those of finding change gears for gear ratios. 728 pages, 196 illustrations.

Postpaid in U. S. In Canada or overseas, \$7.94

MANUAL OF GEAR DESIGN-Three books for everyone who designs or produces cut gears. Section 1—183 pages of mathemati-cal tables especially applicable to gear de-sign. Section 2—168 pages of simple forsign. Section 2—100 pages of simple formulas and time-saving tables for solving all kinds of spur and internal gear design problems. Section 3—172 pages of formulas, charts and tables for helical gears for parallel shaft drives and "spiral" gears for parallel shaft drives and "spiral" gears for non-parallel, non-intersecting shafts. Ap-proved by the American Gear Manufac-turers' Association. 8½" x 11" page size. Combination price, all three sections, \$8.00 Postpaid in U. S. In Canada or overseas, \$9.26

Single volumes, \$3.00. Postpaid in U. S.

In Canada or overseas, \$3.81

GEAR DESIGN SIMPLIFIED-Contains 110 large charts plus working rules and formulas that speed up the solution of problems involving spur and internal gears, single- and double-helical gears, straighttooth and spiral-bevel gears, worm gears, gear ratios, and the power transmitting capacity of gears. 134 pages, 201 drawings

Postpaid in U. S. In Canada or overseas, \$4.80

14,000 GEAR RATIOS-400 pages of tabulated gear ratios-14,000 two-gear and millions of possible four-gear combinations. Covers common fractional ratios and decimal equivalents; decimal ratios, logs and equivalent pairs of gears; total numnumber of teeth with equivalent pairs and ratios; numbers and equivalent gear factors. $8\frac{1}{2}$ " x 11". \$6.00

Postpaid in U. S. In Canada or overseas, \$7.07

MAIL THIS CONVEN	Check Method of Payment						
The Industrial Press, 93 Worth Please send me, postpaid, the b of payment 1 have indicated.	AND AREA CARD AND AREA CO.		☐ 1 enclose check or money order in full payment.				
MACHINERY'S HANDBOOK	MANUAL OF GEAR DESIGN	GEAR DESIGN	☐ I enclose 1/3 down payment (if order				
ENGINEERING ENCYCLOPEDIA	☐ All three volumes	SIMPLIFIED	amounts to \$6.00 or more) and will pay				
MATHEMATICS AT WORK	□ Vol. 1 □Vol. 2 □Vol. 3	14,000 GEAR RATIOS	balance in monthly installments. (\$6.00 to \$9.00, two additional installments. \$10.00 to				
Name	Position		\$20.00, three additional installments. \$21.00				
Company	Street & No		to \$30.00, four additional installments.)				
	Zone State .		☐ Send books postpaid. I will pay within				
(A	It in if you want books sent home)		five days if I decide to keep books. M/3/55				

OIL EXTRACTORS AND CLEANERS

De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS

Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa. Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS

Modison-Kipp Corp., Modison, Wis.

OILS, Cutting

See Cutting and Grinding Fluids.

OILS. Lubricating

Cities Service Oil Co., 70 Pine St., New York, N. Y. N. Y. Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa. Sinclair Refining Co., 600 5th Ave., New Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa. Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y. N. Y. Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa. Sinclair Refining Co., 600 5th Ave., New York. York, Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, III. Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, III.

OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Spelial

Baldwin-Lima-Hamilton Corp., Lima Hamilton Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Corn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Reinberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Chicago Rawhide Mfg. Co., 1309 Elston Ave., Chicago, III.
Crone Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

PAINTING EQUIPMENT, Spray

Lowe Bros. Co., Dayton, Ohio. Ransburg Electro-Coating Carp., 1234 Barth, Indianapolis, Ind.

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I. Lufkin Rule Co., Hess Ave., Saginaw, Mich. Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I. Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass. Norma-Hoffman Bearings Corp., Stamford, Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave.,
New York, N. Y.

PIPE, Steel

PIPE, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New
York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, Ill.
United States Steel Corp., National Tube Co.,
Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du
Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn
R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee
St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois
& Alaska Aves., Detroit, Mich.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Rotary & Lewis Machine Tool Co., rotal Giddings & Lewis Machine Tool Co., rotal Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, III.

PLATE ROLLS

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.

Bethlehem Steel Co., Bethlehem, Pa.

Cleveland Punch & Shear Works Co., 3917 St.

Clair Ave., N. E., Cleveland, Ohio.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Ryerson, Joseph T., & Son, Inc., 2558 W. 16th

St., Chicago 18, III.

PLATES, Angle

Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.

PLATES, Surface

PLATES, Surface
Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave.,
Cleveland, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh & Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Harifford I, Conn.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854
E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.

PHEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Carton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III. III.

Jersoli-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr.,
Easton, Pa.
Logansport Machine Co., Inc., 810 Center
Ave., Logansport, Ind.
Onsrud Machine Works Inc., 3940 Palmer St.,
Chicago, III.

,

*

POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Hill Acme Co., 1201 W. both St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd.,
Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St.,
Rockford, Ill.

POLISHING TOOLS, Portable

Sundstrand Machine Tool Co., 2531 11th St., Rockford, III.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tools

PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa. Dake Engine Co., 604 Seventh St., Grand Haven, Mich. duMont Corp., Greenfield, Mass. Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Logansport Machine Co., Inc., 810 Center
Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St.,
Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N.J.

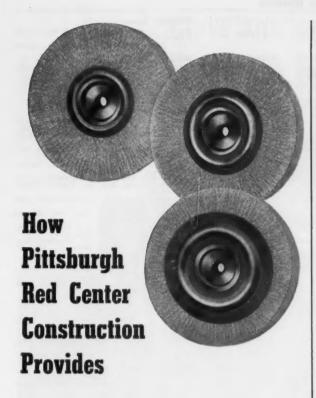
PRESSES, Broaching

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton,
Ohio.

Colonial Broach Co., P.O. Box 37, Harper Sta.,
Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand
Haven, Mich.
Ferrocute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffolo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J.

(Continued on page 380)



Faster cutting while maintaining smooth finish • Freedom from shedding • Perfect balance • Longer life

In conventional brushes, when faster cutting action is desired, coarser wire is used. But increasing the wire gauge causes brittleness, destroying the wearing quality of the brush, and resulting in excessive scoring of the work.

Pittsburgh has solved this problem by maintaining the same ideal gauge wire in every brush, but increasing the fill and diameter of the hub and center plate of brushes designed for faster cutting. Thus, although cutting speed is increased, work remains unscored and the wire does not lose its inherent power to flex. These Red Center brushes last longer, maintain perfect balance throughout life, and do a better job all around.

This is just one example of superior Pittsburgh construction, engineered for both general and specific applications. For details of the complete line, write for free Catalog #54-W. Address: PITTSBURGH PLATE GLASS Co., Brush Div., Dept. W-3, 3221 Frederick Ave., Baltimore 29, Maryland.

PITTSBURGH



PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

CUT PRECISION THREADS FASTER with these 3 COULTER AUTOMATICS!

Whenever you use a Coulter, you'll see production figures skyrocket... production costs plummet. Try any one of these Coulter Automatic Threading Machines — and you'll want all three:





"H1" Hob Thread Milling Machine cuts precision, internal and external threads . . . AUTOMATI-CALLY.



"L1" Threading Lathe cuts precision, square, standard and 29 degree threads... AUTOMATI-CALLY.



"Thread Milling Machine cuts precision, long and short traversing, elevating, cross feed and lead screws ... AUTO-MATICALLY.

Without obligation, consult our engineering staff with your specific threading problems. Catalog and machine specifications available upon request.

MACHINE TOOL BUILDERS SINCE 1896

The Coulter Machine Co.

643 Railroad Ave.

Bridgeport 5, Conn.

PRESSES, Extrusion

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div.,
Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.,
Hydraulic Press Atfg. Co., 300 Lincoln Ave.,
At. Gilead, Ohio.

Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohia. Ferracute Machine Co., Bridgeton, N. J. Nagara Machine & Tool Works, 683 North-land Ave., Buffalo, N. Y.

PRESSES, Forging Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.

American Steel Foundries, Elmes Engrg. Div.,
Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.

Baldwin-Lima-Hamilton Corp., Eddystone Div.,
Philadeliphia 42, Pa.

Bethlehem Steel Co., Bethlehem, Pa.

Bliss Co., E. W., 1375 Raff Rd., S. W. Canton,
Ohio. Bliss Co., E. W., 13/5 Raft Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erle Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N., Y.
National Mchry. Co., Greenfield and Stanton Sts. Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y. Verson Allsteel Press Co., 93rd St., and S. Ken-wood Ave., Chicago, III. Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich. American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-nati, Ohio. nati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio. Ohio.

Chambersburg Engrg. Co., Chambersburg, Pa. Cincinnati Milling Mch. Co., Oakley, Cincinnati Ohio.

Cincinnati Milling Mch. Co. (Hydroform) Cincinnati 9, Ohio.

Cincinnati Milling Mch. Co. (Hydroform) Cincinnati 9, Ohio. Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill. Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich. Dake Engine Co., 604 Seventh St., Grand Haven, Mich. Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio. Erie Foundry Co., Erie, Pa. Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn. Federal Mch. & Welder Co., Warren, Ohio Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

Hannifin Corp., 501 S. Wolf Ka, Des Flatter, III.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, III.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ohio.
Ohio.
Dake Engine Co., 604 Seventh St., Grand
Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working
Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg, Div.,
Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystene Div.,
Philodelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton,
Ohio.
Chambersburg Engrg, Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform) Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Unit of Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard
Aves., Cincinnati, Ohio.
Cleveland Mch. Corp., Div. U. S. Industries, Inc.,
6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Ergine Co., 604 Seventh St., Grand
Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd
Ave., Chicago 50, Ill.
Dreis & Krump Mfg, Co., 7416 Loamis Bivd.,
Chicago 36, Ill.
Pries Foundry Co., Erle, Pa.
Espen-Lucas Machine Works, Front St., and
Girard Ave., Philadelphia, Pa.
Erracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg, Co., 300 Lincoln
Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Mfg, Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J. PRESSES, Sheet Metal Working

3

19

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddoek Rd. and Tennessee Ave., Cincinnati, Ohio.

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, III.

Baldwin-Lima-Hamilton Corp., Eddystone Dlv., Philadelphia 42, Pa.

Chambersburg Engrg. Co., Chambersburg, Pa.

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

Consolidated Mch. Tool Corp., Rochester, N. Y.

Dake Engine Co., 604 Seventh St., Grand Haven, Mich.

Frie Foundry Co., Erle, Pa.

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III. Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio. Lempco Products, Inc., 5490 Dunham Rd., Bed-ford, Ohio ford, Ohio Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y. Springfield Mch. Tool Co., Springfield, Ohio. Verson Allsteel Press Co., 93rd St. & S. Ken-wood Ave., Chicago, III. Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PROFILE-TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. (Lathe).

PROFILING MACHINES

Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio. Consolidated Mch. Tool Corp., Rochester, N. Y. Cosa Corp., 405 Lexington Ave., New York 17, N. Y. N.Y.

(Continued on page 382)

RIGELL

ON HANNIFIN STOCK HYDRAULIC PRESSES

1-TON		0												\$	55	52	
2-TON										0			0	\$	62	27	
5-TON																	
8-TON					0									\$1	,58	31	
0-TON																	
S-TON																	

Prices complete with motors and starters F.O.B. ou press plant, St. Marys, Ohio, subject to change without

DELIVERY FROM STOCK

Demand for these popular presses is so consistent we are able to produce them in quantity and pass the savings along to you.

Construction-wise and quality-wise these small general-purpose presses are identical to the larger Hannisin presses, up to 150 tons. Special, optional controls when needed.

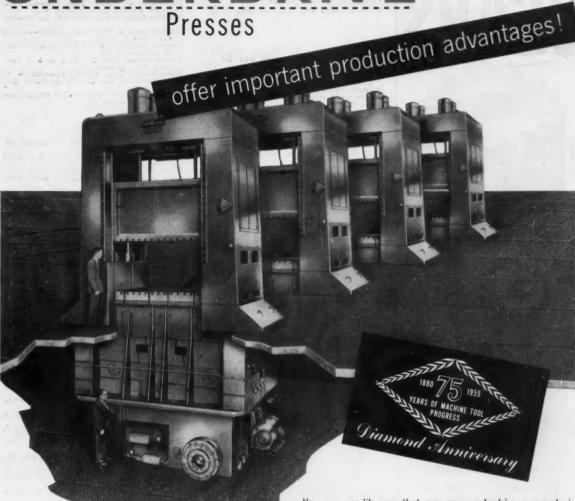
WRITE for complete information on the Hannifin Hydraulic Press you're interested in.

HANNIFIN CORPORATION, 509 S. WOLF ROAD, DES PLAINES, ILLINOIS

Cleveland

UNDERDRIVE

Presses



- Frees overhead space for material flow.
- Enclosed columns keep working parts clean.
- Production area is cleaner and safer.
- Stress is tension rather than compression.
- Faster, more convenient maintenance and adjustment.

You can readily see that our new underdrive press design minimizes press height on your production floor. This means better lighting and more freedom of material flow. Press area stays clean and safe for all drive mechanisms and attendant oil and grease are in separate area. There are no overhanging projections to interfere with material flow. These presses are readily adapted to automatic feeds.

Many companies have already discovered the important operating economies gained by using Cleveland presses. They'll produce profits for you, too! Whatever your press requirements may be, let us show you why Cleveland presses are your best buy. Our recommendations are based on 75 years of machine tool progress.

Established 1880

POWER PRESSES - FABRICATING TOOLS

E. 40th & St. Clair Avenue, Cleveland 14, Ohio

Offices at: NEW YORK . CHICAGO . DETROIT PHILADELPHIA . E. LANSING . OXFORD, O.

CITY FOUNDRY DIVISION - SMALL TOOL DEPARTMENT





RAWHIDE

C/R rawhide transmits high efficiency power, absorbs severe shock loads, saves machinery . . . has an outstanding performance



PHENOLIC and TEFLON

They're quiet, have high resistance to fatigue. Special purpose gears and pinions available in many other materials such as Fabroil and metal.



Write today for descriptive literature

CHICAGO Rawhide MFG.CO. In Canada: Super Oil Seal Mig. Co., Ltd. Hamilton, Ontario

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

PUMPS, Coolant, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620
E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave.,
Logansport, Ind.
Pioneer Pump Div., Detroit Harvester Co.,
14300 Tireman Ave., Detroit 28, Mich.
Ruthman Machinery Co., 1809 Reading Rd.,
Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson
Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers Inc., 1402 Oakman Blvd., Detroit,
Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

PUMPS, Hydreulic

American Steel Foundries, Elmes Engrg. Div.,
Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div.,
Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 160 Dublin St., Columbus
16, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave.,
Mf. Glead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St.,
Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee,
Wis.
Pioneer Pump Div., Detroit Harvester Co., Wis.
Pioneer Pump Div., Detroit Harvester Co.,
14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson
Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St.,
Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit,
Mich. Kockford, III., Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich. Viking Pump Co., Cedar Falls, Iowa. Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Ingersoll-Rand Co., Phillipsburg. N. J.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I., Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich. Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J., Sundstrand Machine Tool Co., 2531 11th St., Rockford, III.

Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich. Mich. Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES

See Dies, Sheet Metal, Etc.

PUNCHES, Centering

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo,
N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves.,
Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Engineering & Research Corp., Riverdale, Md.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,
Ill.
Nigagra Mch. & Tool Warks, 683 Northland III.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th
5t., Chicago 18, III.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.
Wales-Strippet Corp., North Tonawanda, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J.
Wiedermann Machine Co., 4272 Wissahickon
Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, III.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I., Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, III.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass. Woburn, Mass. Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.

REAMER HOLDERS

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.

McCrosky Tool Corp., 1938 Thomas St., Mead-ville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

Warner & Swasey Co., 8701 Carrosis Marie Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

REAMERS

Barber-Colman Co., Rock and Montague, Rockford, III.

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.

Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.

Chicago-Latrobe Twist Drill Works, 411 W.

Ontario St., Chicago, III.

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.

DoAll Co., 254 N. Laurel Ave., Des Plaines, III.

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.

Greenfield Tap & Die Corp., Greenfield, Mass. Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

Keo Cutters, 19326 Woodward, Detroit, Mich. Carbon Corp., 30 E. 42nd St., New York, N. Y Keo Cutters, 19326 Woodward, Detroit, Mich. Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y. McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa. National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich. Pratt & Whitney, West Harrford 1, Corn. Scully-Jones & Co., 1903 Rockwell St., Chlagog 8, Ill. Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I. Union Twist Drill Co., Athol, Mass. Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Collman Co., Rock and Montague, Rock-ford, III. Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich. Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio. Firth Sterling Inc., 3113 Forbes St., Pitts-burgh 30, Pa.

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass. McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

REAMERS, Teper Pia
Butterfield Div., Union Twist Drill Co., Derby
Line, Vt.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland 14, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Greenfield Top & Die Corp., Greenfield, Mass.
Koufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., SyraCuse, N. Y.
Notional Twist Drill & Tool Co., & Winter Bros.
Co., Rochester, Mich.
Prott & Whitney, West Hartford 1, Conn.
Union Twists Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd.,
Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, III.
Suhr Mch. Tool Co., 835 Green St., Ann Arbor,
Mich.
Kaufman Manufacturing Co., Manitowac, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7,
Mass.

RECORDING INSTRUMENTS

National Acme Co., 170 E. 131st St., Cleve-land, Ohio.

REELS, Stock, Standard and Automatic U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc., 19 Rector St., New York,
N. Y.

RETAINING RINGS FOR BEARINGS, Etc. Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place,
Long Island City 1, N. Y.

RHEOSTATS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis. General Electric Co., Schenectady, N. Y.

RIVET SETS

Bethlehem Steel Co., Bethlehem, Pa. Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic

Bethlehem Steel Co., Bethlehem, Pa. Chicago Pneumatic Tool Co., 6 E 44th St., New York, N. Y. Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III.

RIVETERS, Pneumatic

Chicago 18, III.

Wood & Co., P. D., Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y. Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn. Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III. III. Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich. Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio. National Machinery Co., Greenfield and Stan-ton Sts., Tiffin, Ohio.

RUBBER PRODUCTS

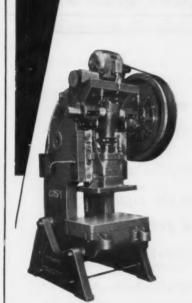
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I. Lufkin Rule Co., Hess Ave., Saginaw, Mich. Millers Falls Co., Greenfield, Mass. Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y. Starrett, The L. S. Co., Athol, Mass.

(Continued on page 384)





Catalog No. 33

FERRACUTE

Open Back Inclinables

32....

43

56

70....

88....

110-Ton Models

How many copies do you need for your Spec Files?



FERRACUTE MACHINE COMPANY

Manufacturers of Power Presses, Press Brakes and Special Machinery

BRIDGETON, NEW JERSEY, U.S.A.

RUST PREVENTIVES

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa. Oakite Products, Inc., 19 Rector St., New York, N. Y. Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

SANDERS

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Ingersoll-Rand Co., Phillipsburg, N. J. Millers Falls Co., Greenfield, Mass. Sundstrand Machine Tool Co., 2531 11th St., Rockford, III.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, Ill.
Barnes, W. O. Co., Inc., Detroit, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa. Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17,
N. Y.
Delta Power Tool Div., Rockwell Mfg. Co.,
614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and
Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton
Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, III. Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, III.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Grob, Inc., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th
St., Chicago 18, III.
Simonds Saw & Steel Co., 470 Main St., Fitch-burg, Mass.
Walker-Turner Div., Kearney & Trecker Corp.,
South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, III. Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y. Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y. Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, III.

SAWS, Circular Metal Cutting

SAWS, Circular Metal Cutting
Barnes, W. O. Co., Inc., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
OAII Co., 254 Laurel Ave., Des Plaines, III.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and
Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Motch & Merryweather Mchry. Co., Penton
Bildg., Cleveland, Ohio.
Notional Twist Drill & Tool Co., & Winter
Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, III.
Delta Power Tool Div., Rockwell Mfg. Co. 614G N. Lexington Ave., Pittsburgh 8, Pa. DoAll Co., 254 Laurel Ave., Des Plaines, III.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.
Simonds Saw & Steel Co., 470 Main St., Fitch-burg. burg, Mass. Starrett, The L. S., Co., Athol, Mass.

SAWS, Portable Electric

Millers Falls Co., Greenfield, Mass.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford. fard, III.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
National Twist Drill & Tool Co., & Winter Bros.
Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, III.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y. Ingersoll-Rand Co., Phillipsburg, N. J.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y. Ingersoll-Rand Co., Phillipsburg, N. J.

SCREW MACHINE TOOLS AND EQUIPMENT

AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.

Brown & Sharpe Mfg, Co., Providence, R. I.
Colonial Broach Co., P.O. Box 37, Harper Sta.,
Detroit 13, Mich.
Gisholf Machine Co., 1245 E. Washington Ave.,
Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia
Aves., Rockford, Ill.
Millers Folls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley
Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave.,
Pawfucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia
40, Pa. POWTUEREI, N. 1. 1825 Bristol St., Philadelphila 40, Pa. Reed Rolled Thread Die Co., P.O. Box 350, Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.



Everyone recognizes this as a sign of going places . . .

And smart gear users know this (CINT) is the sign of the best in gears made to your specifications.

May We Send You Our Brochure?



"Gears...Good Gears Only"

THE CINCINNATI GEAR CO. . CINCINNATI 27, OHIO

SCREW MACHINE WORK

Eastern Mch. Screw Corp., New Haven, Conn. Mueller Brass Co., Port Huron 35, Mich. National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa. Standard Pressed Steel Co., Jenkintown. Pa. Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I. Cone Automatic Mch. Co., Inc., Windsor, Vt. Cosa Corp., 405 Lexington Ave., New York 17, N. Y. Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wisc.

Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, III.

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

Warner & Swasey Co., 5701 Carnegle Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleve-land 13, Ohio. Brown & Sharpe Mfg, Co., Providence, R. I. Gisholf Machine Co., 1245 E. Washington Ave., Madison 10, Wis. Hardinge Bros., Inc., 1418 College Ave., Elmira N. Y. Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt. Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass. Greenfield Tap & Die Corp., Greenfield, Mass. Pratt & Whitney, West Hartford 1, Conn. Threadwell Tap & Die Co. Greenfield, Mass. Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allmetal Screw Products Co., Inc., 821 Stewart
Ave., Garden City, N. Y. (Stainless Steel Chicago Screw Co., Bellwood, III. Lempco Products, Inc., 5490 Dunham Rd., Bed-ford, Ohio National Acme Co., 170 E. fard, Ohio National Acme Co., 170 E. 131st St., Cleveland, Ohio. Ottemiller, W. H., Co., York, Pa. Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New Cork, N. Y. Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y. Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.) Parker-Kalon Div., General American Trans-portation Corp., 200 Varick St., New York, N. Y.

SCREWS, Thumb

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.) Parker-Kalon Div., General American Trans-portation Corp., 200 Varick St., New York, N. Y. Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(Continued on page 386)



To Help You Select the Best Speed Reducer for Each Job

Horsburgh & Scott's new catalog provides you with all the information necessary for the proper selection of speed reducers.

Complete size range available, including new sizes.

New ratios and ratings for Worm Helical Speed Reducers

Increased Overhung Load capacities are listed and explained.

Detail dimensions of standard worms and gears are given to help you "build-in" Horsburgh & Scott Speed Reducers.

New Rating Tables-more complete than ever before-easier

Engineering Data Section-more tables and data you want.

All this information and much more is available in this catalog to you for the asking. Just write us on your letterhead for catalog 55 -no charge, no obligation.

HORSBURGH & SCOTT

GEARS AND SPEED REDUCERS

5112 Hamilton Avenue Cleveland 14, Ohio

SEALS AND RETAINERS, Oil or Grease Crone Packing Co., 1800 Cuyler Ave., Chicago,

Garlock Packing Co., Palmyra, N. Y.

National Forge & Ordnance Co., Irvine, Warren County, Pa. Standard Pressed Steel Co., Jenkintown, Pa.

Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17. N. Y. Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill. Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill. Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O. South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio. Miles Machinery Co. Box 770, Saginaw, Mich. Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y. Pratt & Whitney, West Hartford 1, Conn. Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y. The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa. Cumberland Steel Co., Cumberland, Md. National Forge & Ordnance Co., Irvine, Warren County, Pa. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SHAPES, Structural

Bethlehem Steel Co., Bethlehem, Pa. U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

3

19

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, III. National Acme Co., 170 E. 131st St., Cleve-land, Ohio. The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa. Buffalo Forge Co., 490 Broadway, Buffalo, N. Y. Buffalo Forge Co., 470 Broading,
N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves.,
Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,
III. III.
Niggara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, III.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.
Watson-Stillman Co., Div. H. K. Porter Co.,
Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohlo.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa. Cumberland Steel Co., Cumberland, Md. De Laval Separator Co., Poughkeepsie, N. Y. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.

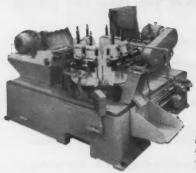
SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Onsrud Machine Works, Inc., 3940 Palmer St., Chicogo, III.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

Precision Pumps for Precision Machinery



GUSHER

Hartford Special Drilling Machine Equipped With a Ruthman Gusher Coolant Pump.



Gusher Coolant Pumps are precision built of the finest materials. The rotating shaft is electronically balanced to cut vibration wear to an absolute minimum. The motor is totally inclosed and drip-proof. The heavy-duty ball-bearings are pre-lubri-cated. You can specify Gusher Coolant Pumps for your precision machinery with the sure knowledge that they will give you efficient service at low maintenance cost.

THE RUTHMAN 1807 Reading Road

MACHINERY CO. Cincinnati, Ohio

SHEARS, Rotary

SHEARS, Rotary
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton,
Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St.
Clair Ave, N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, III.
Simonds Saw & Steel Co. (Knives), 470 Main
St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio. Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio. Columbia Div., Lodge & Shipley Co., Hamilton Columbia Div., Lodge & Shipley Co., Hamilton I, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland
Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main
St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.

SHEET METALS

American Brass Co., 25 Broadway, New York, N. Y. Bethlehem Steel Co., Bethlehem, Pa. New Jersey Zinc Co., 160 Front St., New York, N. Y. N. Y. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St. Chicago 18, III. U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEET METAL MACHINES, Shrinking, Stretching, Forming & Flanging.

Engineering & Research Corp., Riverdale, Md.

(Continued on page 388)



Cam Milling Machine No. 348.

THE ROWBOTTOM MACHINE CO.

WATERBURY

CONN.





MITTS & MERRILL

64 Holden Street . SAGINAW, MICHIGAN

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, III.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp.,
Div., Columbia Steel Co., Div., Tennessee
Coal, Iron & R. R. Co., Div.), 436 7th Ave.,
Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio. Greenfield Tap & Die Corp., Greenfield, Mass. Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y., National Twist Drill & Tool Co., Rochester, Mich. Pratt & Whitney, West Hartford 1, Conn. Scully-Jones & Co., 1903 Rockwell St., Chicago 8, III. Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio. Consolidated Mch. Tool Corp., Rochester, N. Y. Lobdell United Co., 2000 "G" St., Wilmington 99, Del. Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.
Chicago-Latrobe Twist Drill Wks. 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

Pratt & Whitney, West Hartford 1, Conn. Scully-Jones & Co., 1903 Rockwell St., Chicago 8, III.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio. Axelson Mfg. Co., P.O. Box 15335, Verona Sta., Los Angeles 58, Cal. Baird Machine Co., 1700 Stratford Ave., Strat-ford, Conn.

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa. Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio. Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio. Barnes Drill Co., 814 Chestnut, Rockford, Ill. Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill. Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass. Bethlehem Steel Co., Bethlehem, Pa. Bethlehem Steel Co., Bethlehem, Pa. Bigram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa. Birdsboro Steel Edy. & Mch. Co., Birdsboro, Pa. Blanchard Mch. Co., 64 State St., Cambridge, Mass. Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton,
Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor,
Mich.
Chembershurg, Engre, Co. Chembershurg, Rd.

Buni Mch. 1001 Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pr.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philodelphia, Pa.
Ex-Celi-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholf Machine Co., 1245 E. Washington Ave.,
Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Gotton, Gea., Mch. Co., 1110 W. 13th St.,
Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia
Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines,
Ill.
Harnifin Corp., 501 S. Wolf Rd., Des Plaines,
Ill.
Hartford Special Mchry. Co., 287 Homestead Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn. Hill Acme Co., 1201 W. 65th St., Cleveland 2, St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Ohio.
Hydraulic Press Mfg. Co., 30 Lincoln Ave.,
Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
La Saile Tool Co., Inc., 3840 E. Outer Drive,
Detroit 34, Mich.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNicholas Rd.,
Detroit 12, Mich.
Milholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood,
Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton
Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., 9 7th and

3

19

Motch & Merryweather Mchry. Co., Penton Bildg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Notional Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Voonsocket, R. I.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.
Vicaco Mch. Corp., Wayne Junction, Philadel-phia, Pa.

Waltham Machine Works, Newton St., Wal-tham, Mass.
Wicaco Mch. Corp., Wayne Junction, Philadel-phia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleve-land 23, Ohio.

SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

SPINDLES, Boring and Milling Pope Mchry. Corp., Haverhill, Mass.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Pope Mchry. Corp., Haverhill, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

Now Latest Information on Viking Pumps!

CATALO

☐ B-J General Purpose Pumps C-J Heavy Duty Pumps

D-J **Underwriter Pumps**

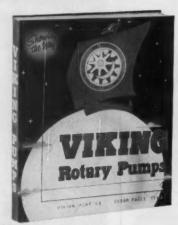
E-J Jacketed Pumps

F-J Sanitary Pumps

G-J Oil Industry Pumps ☐ H-J LP-Gas Pumps

- I- J Hydraulic Pumps

Special Application ☐ J-J Pumps





Just check the catalogs you want. Attach to your letterhead, sign and mail.

PUMP COMPANY

Cedar Falls, Iowa See our catalog in SWEETS

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass. Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

19

Boston Gear Work, 3200 Main St., North Quincy 71, Mass. Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn. Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa. Stahl Geor & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn. Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Bethlehem Pa. Carpenter Steel Co., Bethlehem, Pa. Carpenter Steel Co., Bethlehem, Pa. Carpenter Steel Co., Reading, Pa. Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa. 113 Forbes St., Pittsburgh 30, Pa. National Forge & Ordnance Co., Irvine, Warren County, Pa. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill. Simonds Saw Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio. U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa. Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Bethlehem Fa. Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.
Timken Roller Bearing Co., Canton, Ohio. U. S. Steel Corp., (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa. Wheelock-Lovejoy & Co., Inc., Cambridge, Mass. Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong
Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Carpenter Steel Co., of America, Oliver Bldg.,
Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge,
Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg.,
Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge,
Mass.

STEEL, Stainless

STEEL, Stainless
Allegheny Luddum Steel Corp., Pittsburgh, Pa. American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Bethlehem Steel Co., Bethlehem, Pa. Carpenter Steel Co., Reading, Pa. Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill. Timken Roller Bearing Co., Canton, Ohio. U. S. Steel Corp., American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa. Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Bethlehem Steel Co., Bethlehem, Pa. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, III.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegle-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Carpenter Steel Co., Reading, Pa. Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel

STEEL BARS

See Bars, Steel

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I. Starrett, The L. S., Co., Athol, Mass.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCK STOPS

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

(Continued on page 390)

You can be sure

you're planning your production properly if you've considered the advantages of

Marblette **Plastic Tooling** Resins

which can speed designs from drawing board to production run, require no heavy equipment investment or highly skilled labor, facilitate pilot runs and design changes, and

will save you up to 70% in time and up to 80% in cost

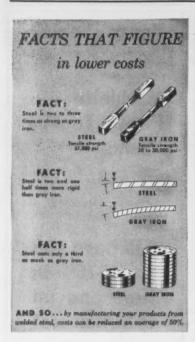
in making stretch dies, draw dies and panels, match dies, jigs, fixtures, patterns, models, prototypes, core boxes, plating shields, bag and contact molds, latex dip production forms, molds for fibrous glass lay-up, spray-metal backing, vacuum-forming, and electro-forming, and other types of tools and dies.

The versatile yet specialized liquid epoxy and phenolic resins developed by Marblette fit into your production picture. Convince yourself-see how they can give you increased economy and efficiency-use the handy coupon below for resin samples, technical data, a phenolic data folder, an epoxy data folder, and a conversion computer that shows at a glance how much resin to use for casting any size product or part.

Marblette

•••••
The Marblette Corporation 37-33 Thirtieth Street Long Island City 1, N. Y. We are interested in plastic tooling
Please Technical Literature send Phenolic Data Folder Epoxy Data Folder Conversion Computer
Name
Title

Company.....



HOW YOU CAN

BECAUSE steel is stronger, more rigid than iron, yet costs a third as much per pound, costs on many products can be cut up to 50%.

Savings like this can be realized on your products without disrupting production. Simply change over your designs one part at a time.

COSTS 45% LESS



Feeder roll is built from standard channel welded to steel discs. Steel design eliminates breakage, weighs balf of former casting. Saves 45% on cost of manufacture.

COSTS 30% LESS



Machine bracket is welded from 10 gauge metal. Weighs half as much as original cast design. Costs 30% less to produce.

A Lincoln representative will gladly work with you to cut your production time. He can show you how to simplify design details . . . cut costly man-hours. Call him or write on your letterhead.

THE LINCOLN ELECTRIC COMPANY

Dept. 1201, Cleveland 17, Ohio
THE WORLD'S LARGEST MANUFACTURER OF
ARC WELDING EQUIPMENT

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Top & Die Corp., Greenfield, Mass.
Prott & Whitney, West Hartford I, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

STONES, Oil or Sharpening

Carborundum Co., Buffolo Ave., Niagara Falls, N. Y. Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire
U. S. Tool Co., Inc., 255 North 18th St.,
Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio. Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa. Chambersburg Engrg. Co., Chambersburg, Pa. Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich. Consolidated Mch. Tool Corp., Rochester, N.Y. Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III.

Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio. Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, III.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STUD SETTERS

Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y. Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, III.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE CHECKING EQUIPMENT

Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

SURFACE PLATES

See Plates, Surface

SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio. Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.

SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis. General Electric Co., Schenectady, N. Y. National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TANGS, Replaceable, Drill & Reamer
Nu-Tangs Inc., 1335 Bates St., Cincinnati,
Ohio.

TAPER PINS, Standard

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.) Chicago Screw Co., Bellwood, III. DoAII Co., 254 N. Laurel Ave., Des Plaines, III. Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24
Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St.,
Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago
8, Ill.
Tapmatic Corp., 845 W. 16th St., Costa Mesa,
Cal.

TAPPING ATTACHMENTS

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101,
Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor,
Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24
Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Leland-Gifford Co., 1425 Southbridge St.,
Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet
St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St.,
Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriffmaster Products Corp., 1076 N. Plum St.,
Lancaster, Pa.

TAPPING MACHINES

Avey Drilling Mach. Co., 26 E. Third St., Cavington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101,
Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St.,
Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave.,
Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport,
Conn.
Buffalo Forge Co., 490 Broadway, Buffalo,
N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor,
Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6,
Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia
Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead
St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2,
Ohio.
Kaufman Manufacturing Co., Manitawoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.

-8

Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass. Machinery Co., 6402 Westfield, Blvd., Indianapolis 5, Ind. Moline Tool Co., 102 20th St., Moline, Ill. Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio. National Acme Co., 170 E. 131st St., Cleveland, Ohio. Notional Automatic Tool Co., Inc., S. 7th and N. Sts., Richmend, Ind. Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill. Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill. Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O-Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill. Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass. Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Threadwell Tap & Die Co., Greenfield, Mass.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn. Landis Mch. Co., Waynesboro, Pa. National Acme Co., 170 E. 131st St., Cleve-land, Ohio. Sheffield Corp., 721 Springfield St., Dayton 1,

TESTING EQUIPMENT, Tension,

Compression, Fatigue, etc.

Olsen, Tinius, Testing Mch. Co., Willow Grove,

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I. Cosa Corp., 405 Lexington Ave., New York 17, N. Y. Coulter, James, Machine Co., Bridgeport 5, Coulter, James, Machine Co., Bridgeport S, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn. Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport S, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio. Ohio.

Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio
Prott & Whitney, West Hartford I, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St.,
Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston
35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St.,
New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Pierce Mfg., Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, III.
Defroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn. Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. tillows Gear Shaper Co., 78 River St., Spring-field, Vt.

Geometric Tool Co., Westville Station, New Haven 15, Conn. Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich. Hill Acme Co., 1201 W. 65th St., Cleveland 2,

Ohio. Landis Mch. Co., Waynesboro, Pa. Pratt & Whitney, West Hartford 1, Conn. Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass. Sheffield Corp., 721 Springfield St., Dayton 1,

Ohio Taft-Peirce Mfg. Co., Woonsocket, R. 1. Wesson Co., 1220 Woodward Heights Bivd., Ferndale, Mich. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn. Lees-Bradner Co., Cleveland, Ohio Pratt & Whitney, West Hartford 1, Conn. Sheffield Corp., 721 Springfield St., Dayton 1, Waltham Machine Works, Newton St., Wal-tham, Mass.

THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

THREAD ROLLING MACHINES

Landis Machine Co., Waynesboro, Pa. Hartford Special Mchry. Co., 287 Homestead St., Hartford, Con. Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Termessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

TOOL BITS, High Speed Steel

Allegheny Ludium Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong
Ave., Chicago, III.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg.,
Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh
30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson,
Detroit, Mich.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, III.
Simonds Saw & Steel Co., 470 Moin St., Fitchburg Mass.
Wesson Co., 1220 Woodward Heights Blvd.,
Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge,
Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludium Steel Corp., Pittsburgh, Pa. Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Ploines, Ill. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y. Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa. Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich. (Continued on page 392)

BALANCE is why du MONT High Speed, Ground, Square and Rectangular

TOOL BITS DO MORE...COST LESS



Wear resistance, toughness, red hardness - du Mont Bits put all three together. One quality isn't built up at the expense of another. That's why du Mont Bits do more - give you more cuts per bit and per dollar - keep their keen cutting edge - last and LAST! Make your own tests of com-

parative performance and you'll standardize on du Mont H. S. Tool Bits.





The	du	MONT	CORPORATION,	Greenfield,	Mass.
-----	----	------	--------------	-------------	-------

Please mail free	Tool Bit	COMPARISON	CHART,	CATALOG	and	PRICE
LIST M to						

Name	
Company	
Address	
City	State

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn. Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill. Davis Boring Tool Div., Giddings & Lewis Ma-chine Tool Co., Fond du Lac, Wis. Gairing Tool Co., 21225 Hoover Rd., Detroit Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Varner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass. Brown & Sharpe Mfg. Co., Providence, R. I. Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y. Starrett, The L. S., Co., Athol, Mass. Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL RESINS

Marblette Corp., 37-33 Thirtieth St., Long Island City 1, N. Y.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg.,
Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh
30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

TOOLS, Carbide-Tipped

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237,
Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Larbobe Twist Drill Works, 411 W.
Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St.,
Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh
30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit
32, Mich.

30, Pa.
Gairing Tool Co., 21225 Hoover Ra., 232, Mich.
32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

Mera Cabon Mera Cabon Mich.

Mich.

Union Twist Drill Co., Athol, Mass.

Valenite Metals Corp., Box 205, Royal Oak, Mich.

Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

Whitmon & Barnes, 40600 Plymouth Rd., Plymouth, Mich. Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa. Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Cons. Tool Co., 5200 W. Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill. Bullard Co., Brewster St., Bridgeport 2, Conn. Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa. Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich. Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TRANSFER MACHINES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut St., Rockford,
III. III.
Barnes, W. F. & John, Co., 201 S. Weter St.,
Rockford, III.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor,
Mich.
Colonial Broach Co., P.O. Box 37, Harper
Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit
32, Mich.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, III.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed
Oilgear Co., 1569 W. Pierce St., Milwaukee,
Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe
Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St.,
Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Sillman St., Bridge-port 5, Conn.

TUBE FORMING AND WELDING MACHINES

Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

3

8

TUBE MILLS

Abbay-Etna Co., 2444 Maplewood Ave., Toleda 10, Ohio. American Electric Fusion Corp., 2622 Diversey Ave., Chicago, III. Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y. N. Y. Mueller Brass Co., Port Huron 35, Mich. Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.



FOR AIR OPERATION OR STANDARD 1000 P. S. I. OIL SERVICE

Complies with BOTH J. I. C. Pneumatic and J. I. C. Hydraulic Standards!

- New Series "S" Hydro-Line Cylinders
- 95% efficient at 100 PSI air pressure
 98% efficient at 1,000 PSI oil pressure
- The standard Automation Cylinder of the Automotive Industry
- Compact, flexible design
- Advanced design of cushions in the Series "S" make it possible to use the full stroke on these cylinders at higher speeds and loads than the conventional type.

Write today for FREE catalog

hydro-line Manufacturing Co.

5664 PIKE ROAD . ROCKFORD, ILLINOIS

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cărpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm.
Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St.,
Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS

See Drills, Twist

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wassen Ave., Springfield 7, Mass. Boston Gear Works, 3200 Main St., North Quincy 71, Mass. Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St.,
Salem, Ohio.
Lehigh Foundries, Inc., 1500 Leigh Dr.,
Easton, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston
35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate,
Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincin-nati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, III.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, III. Hil.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1400 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis. Oligear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, III.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Ookman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

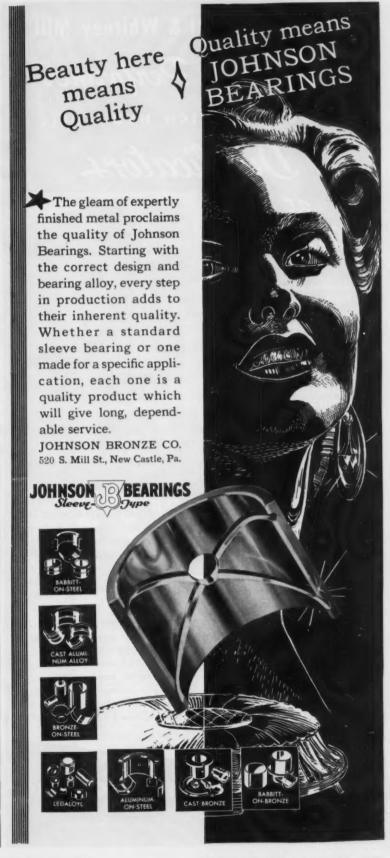
VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

8

Armstrong-Blum Mfg. Co., 5700 W. Blooming-dale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill. Logansport Machine Co., Inc., 810 Center
Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave.,
Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New
Britain, Conn.
(Continued on page 394)



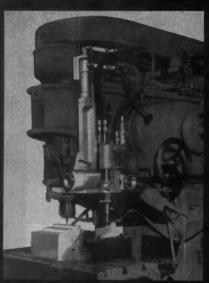


GOODRICH HYDRAULIC

Duplicators

LOW COST

Hundreds of new milling operations are now possible with time and cost-saving GOODRICH DUPLICATORS. Pratt & Whitney mills gain new versatility with this rugged, custom-designed, rigid tracer **DUPLICATOR** attachment.



TEMPLATE TRACING exact copies of complex contours are quickly traced from master templates of rigid material. A support bracket mounted on cross slide leaves table free to travel. Narrow template frees table area for work.

MASTER DUPLICATINGcontours are traced from any 3-dimensional model with work and model mounted on table. Simplifies set-ups by 2way horizontal and 1-way vertical adjustment of Duplicator

POWER FEED BORING a boring control feature provides power feed to the head with infinite feed from 1" to 30" per min. The tracer-finger or micrometer stop is utilized for semi - automatic boring opera-

4 STRAIGHT MILLING unlike many duplicators, the GOODRICH HYDRAULIC **DUPLICATOR** interferes in no way with regular hand controls for straight milling of contours, bosses, etc. Shuts off quickly and is easily swung aside.

Send for Booklet A-2 for full information

AUTOMOTIVE SERVICE TOOLS, INC.

Division of Lansing Die Sinking Co.

617 May Street

Lansing, Michigan

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind. Universal Engineering Co., Frankenmuth 2, Mich. U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper

Brown & Sharper and Shaper
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elan and Garrard Aves.,
Cincinnati, Ohio.
Rockford, Mth. Tool Co., 2500 Kishwaukee St.,
Rockford, III.
Skinner Chuck Co., 344 Church St., New
Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison
St., South Bend, Ind.

19

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, Lock

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel Ave., Garden City, N. Y. (Stainless Steel only.) Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

WASHERS, Spring

Allmetal Screw Products Co., Inc., 821 Steamt Ave., Garden City, N. Y. (Stainless Steel Ave., Garden City, N. Y. (Stainless Steel only.) Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich. Federal Mch. & Welder Co., Warren, Ohio General Electric Co., Schenectady, N. Y. Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

WELDING EQUIPMENT, Electric, Spot.

Butt, Seam, Etc.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa. Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federol Machine & Welder Co., Warren, Ohio.

WELDING POSITIONER

duMont Corp., Greenfield, Mass.

WELDMENTS

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio. Mahon, R. C., Co., Detroit 34, Mich. Verson Allsteel Press Co., 93rd St. & S. Ken-wood Ave., Chicago, III.

WIPERS

19

Scott Paper Co., Chester, Pa.

WIRE

American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio. Bethilehem, Steel Co., Bethilehem, Pa. U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn. U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton,
Ohio. Ohio. National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio. Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY

Delta Power Tool Div., Rockwell Mfg. Co., 6146 N. Lexington Ave., Pittsburgh 8, Pa. Frew Machine Co., 121 East Luray St., Phila-delphia 20, Pa. Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill. Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

WORM DRIVES

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio. Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

WRENCHES

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Ingresol-Rand Co. (Impact, Pneumatic, Elec-tric), Phillipsburg, N. J. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Detachable Socket

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III.

WRENCHES, Ratchet

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicogo, III. Williams, J. H. & Co., 400 Vulcan St., Buffolo 7, N. Y.

WRENCHES, Top

Butterfield Div., Union Twist Drill Co., Derby Line, Vt. Cord, S. W., Mfg. Co., Div. Union Twist Orill Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Orill
Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

WRENCHES, Torque Measuring

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, III. Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

New Jersey Zinc Co., 160 Front St., New York, N. Y.





Giving full particulars on the New Tap King and the com-plete line of Tapping Machines.

PROCUNIER

Safety Chuck Company 16 S. Clinton St. Chicago 6, III.

Procunier SAFETY CHUCK CO. 16 S. Clinton St., Chicago 6, III. Dept. 3 Gentlemen: Please send your illus-trated brochure giving complete details, specifications and prices. Name Address City Zone State

ACCURATE ALIGNMENT INSURES CLEAN-CUT STAMPINGS

the said with the

Waltham Sub-Presses can materially lower costs and increase output on small, complicated punchings and stampings. The overhang type is ideal for second or third operations, its fully exposed front and rear openings providing ample light and space for locating work. The arch type is especially suitable for strip work, Rigid construction of both designs, with plunger bearings adjustable for wear, assures accurate alignment. Built in sizes from 1 3/16" to 6" plunger diameter. Write for bulletins describing Waltham Sub-Presses and Waltham machines for thread milling and gear cutting.



/ALTHAN TRADE MARK

MACHINE WORKS

Newton St., Waltham, Mass.

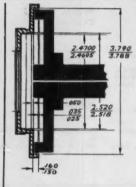
QUICK, LOW COST OPERATION is mude possible

by the Davis tilting table, which permits even work tapering as much as 3" per foot to be set up and cut quickly. And Davis multiple tooth cutters make quick work of all keyways up to 1" in width.

Let us work out setups to speed up your production.

Write for Bulletin

COMPANY
405 EXCHANGE ST.
ROCHESTER 8, N. Y.



Gaging SHALLOW HOLES done easily

to fractions of .0001"

COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 8" dia.

UNIQUE ADVANTAGES

Positive gaging accuracy to fraction of .0001" regardless of who operates it. Indicates actual size, a fixed—not passing—reading.

Positive 2-point gaging—automatic centerina.

centering.

Shallow holes, deep holes, inside splines, open-end holes gaped easily. Detects ovailty, back or front taper, hell mouth, barrel shape. Reaches to bottom of blind holes. Gapes work while still held in the church.

A shop tool for all-day every day Portable-no wires, hoses or stands.

Investigate the gage used by the thousands in jet engine, guided missile, farm machinery, automatic transmission, household appliance and other volume-precision plants. IT MAKES PRECISION GAGING EASY... at machine... at inspection bench... for selective assembly. No other like it—investigate and see why.

COMTOR CO. 74 Farwell St. Waltham 54,



GET THE FACTS-REQUEST BULLETIN 48



SIMPLEX-M ABRASIVE BAND GRINDER

The precision of a machine tool plus the durability of a workhorse. Complete with 1/2 H.P. Heavy Duty Motor and automatic band tension control. Nothing like it for finishing metals, plastics, wood, fibre, etc.

OTHER STYLES AND SIZES IN NEW MANUAL ON FINISHING WRITE TODAY

WALLS SALES CORP. 333 Nassau Avenue, Brooklyn 22, N.Y.



IMPROVE FACING OPERATIONS

ON BORING MILLS - DRILLS - LATHES MILLERS AND RADIALS

M-D facing Head feeds automatically. Lathe tool bit travels radially from center outward or reverse. 10 sizes, 6" to 46" dia. Write for bulletin, prices.

MUMMERT-DIXON CO. 126 Philadelphia St.





THE EASTERN MACHINE SCREW CORP., 23-48 Barclay St., New Haven, Conn. Pacific Coast Representative: A. C. Behringer, 334 N. San Pedro St., Los Angeles, Calif. CANADA: F. F. Barber Machinery Company, Toronto.

NT PIONEERS IN RIVETING

OVER 50 YEARS' EXPERIENCE



BOTH SPINNER AND HAMMER TYPES

Single and Multiple Spindles-Vertical and Horizontal-Automatically or Foot-Operated. Handles rivets from the smallest and most delicate up to 34" diameter.

THE GRANT MFG. & MACHINE CO.

Bridgeport 5, Conn.



INSERTED-BLADE MILLING CUTTERS AND SINGLE-POINT TOOLS FOR ALL METAL-CUTTING NEEDS



APEX TOOL BITS FIT MOST STAND-ARD HOLDERS

13



If you haven't yet changed to Apex, you can begin to get acquainted by using Apex Bits in your present holders. The Apex line includes Single-Point Round Shank (as shown) and Shankless Serrated-plus Inserted-Blade Milling Cutters of all different styles. Write for catalog.



PROMPT SHIPMENT FROM OUR LARGE COMPLETE STOCK

APEX TOOL & CUTTER CO., Inc., Shelton 11, Conn.



Write for latest Bulletins EDLUND MACHINERY CO.





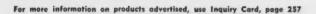
STEEL HAND AND POWER

For Single and Quantity Runs Bending Steel Plate and Sheet Metal

Special Bending Brakes **Double Folder Brakes**

MANUFACTURING COMPANY

7412 S. Loomis Blvd., Chicago 36, Il



OUTLASTS DEAD CENTERS
MANY TIMES OVER!

UNCHALLENGED ACCURACY!

Get every dollar's worth of production from QUADRO PRECISION LIVE CENTERS—designed to support the HEAVIEST load at HIGHEST speed for the LONGEST time! Guaranteed accurate to .00005"—they will outlast dead centers by far!

Each QUADRO CENTER completely eliminates friction—two double row pre-loaded ball bearings absorb combined radial end thrust. You'll discover its remarkable efficiency on a lathe, miller OR ANY OTHER MACHINE TOOL!

TODAY—see your regular supply dealer for Complete Facts or write to:

DAKON

TOOL & MACHINE CO., INC. New Hyde Park, L. I., N. Y.

"TWO DECADES OF IMPORTANT
TOOL PARTS PRODUCTION"



HARDNESS TESTING

Brinell-Shore-Scale

Included in our improved Portable Scleroscope Model D-1. This efficient single scale tester registers Brinell-Shore values without damage to the work. The old standby for forty-three years.

WRITE FOR CIRCULAR

THE SHORE INSTRUMENT & MANUFACTURING CO., INC.

90-35 Van Wyck Expressway, Jamaica, 35, N.Y.





GEARS

Made to Your Specifications

You and we can form a team—you to draw up the specification; we to make the gears—that will be profitable to both of us. Gears of all types, all sizes, all materials. Design-engineering service available.

Custom Gears Exclusively 13

DIEFENDORF GEAR CORPORATION

Syracuse 1, N. Y.

DIEFENDORF G E A R S



GEARS -ALL MAKES . . . Special and Standard

PRECISION GEARS UP TO 200 DIAMETRAL PITCH

All Gears certified for Accuracy Quality and Fine Workmanship

NEW JERSEY GEAR & MFG. CO. 1470 Chestnut Ave. Hillside, N. J.

GEAR

HOBBING SHAPING GENERATING LAPPING SHAVING

WILLIAMSON GEAR & MACHINE CO. 2606 MARTHA ST., PHILADELPHIA 25, PA. REgont 9-8

For more information on products advertised, use Inquiry Card, page 257

SPURS TO 72" PD, 1 DP

These four perfectly matched sets of steel bevel gears were built by Stahl to exacting Navy specifications for use on floating docks. Stahl's specialized experience and ample facilities are yours to command. For gears in any size—any quantity, precisely made and delivered on time—get your next estimate from Stahll

SPIRAL, HELICAL and WORM GEARS TO 48" PD, 2 DP CONTINUOUS-TOOTH HERRINGRONE TO 60" PD, 2 DP SPROCKETS TO 72" PD, 21/2" CP RACKS TO 20 FT LONG 3 DP SILENT GEARS; RAWHIDE, BAKELITE, FIBROIL HEAT-TREATED, CASE OR FLAME HARDENED GEARS — OF CARBON OR ALLOY STEEL



GEAR & MACHINE COMPANY 3901 Hamilton Ave. Cleveland 14, Ohio

The "JOHN'S" DRILL JIG

A versatile, self-centering work holding device for accurate

- Drilling
- Tapping
- Milling

and many other chucking purposes.

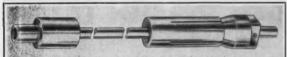
Write for literature

HEUSER MANUFACTURING COMPANY

1644 W. Paulina St., Chicago 22, III.



BEVELS TO 54" PD, 1 DP



PATENT RIGHTS FOR SALE OR LEASE ON KNAPP COLLET & CHUCK STOPS

If stock comes to turret stop, collet will draw stock away .005 to .025 because stock draws WITH collet. But, with KNAPP COLLET & CHUCK STOP, the lathe collet is attached to draw tube; the stop is anchored to draw tube, consequently distance from end of lathe collet to stop must remain identical. Action of lathe collet draws stock against stop then must slide on stock remainder of closing distance.

B. L. KNAPP INDUSTRIES

107 N. Franklin St. Syracuse 4, N.Y.



ANGLE BEVEL **GEARS WITH** GENERATED TEETH-BILGRAM

Correct—from every angle! BIL-GRAM angle bevel gears with generated teeth are produced on the latest BILGRAM equipment by specialists with over 70 years' experience in meeting industry's most difficult gear requirements. You can be sure that they are designed right and cut right.

Our complete plant is equipped to produce any kind of gear you need—Bevels of all kinds . . . Ellipticals . . . Herringbones . . . Helicals . . . Racks . . . Spurs . . . Hypoids . . . Worms and Worm Gears. It will pay you to take advantage of BILGRAM engineering service on your next gear problem.



FOR ALL TYPES OF GEARS

BILGRA

Manufacturers of Bevel Gear Generators and Chamfering Machines

1217-1235 SPRING GARDEN ST.

PHILADELPHIA 23, PA.

Classified and Re-Sale Section

eastern Rebuilt Machine Tools

THE SIGN OF QUALITY-THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment, Our prices are realistic with today's market and our quality of rebuilding is the same high standard-THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS.

AUTOMATICS

%" Cleveland Model B, belt
No. 6E Fotter & Johnston, m.d.
14" By Blander Type m.d.
No. 8A Cleveland, m.d., 8" esp., latest
Model B.—1 1/16" Cleveland, m.d.
4 spindle 196" Cleveland Model M, m.d.
No. 5 DELX Potter & Johnston, m.d., late
Model A.—1 %" Cleveland Single Spindle, late
Model A.—1 %" Cleveland Single Spindle, late
Model A.—2" Cleveland Single Spindle, late
Model M, M, Shark M,

BOLT THREADERS

Victor Nut, Facing Machine, m.d., cap. %" to 2" nuts
1" Landis Double Spindle, m.d., thru gear box
14" Landis 2 spindle, late
14" Landis 2 spindle, late
14" Landis 2 spindle, loder type
No. 326 Oster Bolt & Pipe Thread Machine, m.d.

HORIZONTAL BORING MILLS

HORIZONTAL BORING MILLS

A Universal Horizontal Boring Mill, m d.

37 Glddings & Lewis, m.d., late

0. 32 Lucas, m.d., late

0. 32 Lucas, m.d., late

1. 22 Lucas, m.d., late

1. 24 Lucas, m.d., late

1. 25 Lucas, m.d., late

1. 26 Lucas, m.d., late

1. 27 Lucas, m.d., late

1. 27 Lucas, m.d., late

1. 28 Lucas, m.d., la slots for Plate 40" wide x 22' long x 7" thick, 4 rows T

slots Pair Floor Plates 32" wide x 18' long x 10 1/2" thick No. 410 W. F. & John Barnes Heriz. Bering & Drilling Machine, m.d., late VERTICAL BORING MILLS

36" Bullard, m.d.
42" Bullard New Era, m.d.
42" Bullard New Era, m.d.
42" Klign New Era, m.d.
42" Klign, with side head and plain swivel head on rall
44" Futnam, m.d., p.r.t.
44" Niles. m.d., p.r.t.
44" Niles. Dement-Pont Car Wheel Borer, m.d.
53" Niles Heavy Fattern, m.d., p.r.t.
100" Niles Heavy, m.d., p.r.t.
102" Niles Wheavy, m.d., p.r.t.
12" Niles wheavy, m.d., p.r.t.
12" Niles wheavy, m.d., p.r.t.

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke Single Ram Vertical Surface LaPointe, m.d., late
Type SBD-42-6 American Vertical By, Dup. Broach
Type SBD-48-15 American Vertical Dual Ram Surface
Hydro Broach Hydr. Broach Oilgear Hydraulie Broach, type XA, 54" stroke, m.4.

RADIAL DRILLS

2'-9" col. Fosdick, m.d.
2'\[6'-10"\] col. American Triple Purpose Plain, m.d.
2'\[6'-10"\] col. American Triple Purpose Plain, m.d.
3'-3" col. Cincinnati-Bickford, m.d.
3'-13" col. Cincinnati-Bickford Super-Service, m.d.
4'-11" col. Morris, m.d. on arm
4'-13" col. Cincinnati-Bickford Plain, m.d.
5'-14" col. Carlton, m.d.
7'-16" Col. Carlton, m.d.
7'-16" Col. American Triple Purpose, m.d.
8'-17" col. Dresse, gear box m.d.
8'-19" col. Cincinnati-Bickford Super-Service, m.d.
Zewo Precision Universal Bench Type Radials, m.d., new Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS

No. 15 Buffalo Floor Model, m.d.
No. 18 Canedy Otto Bench Model, m.d.
Providence Engineering Co., Model E. a.p.d.
No. 45, 1, 2, 3 Avey, belted m.d.
No. 18 Edlund, m.d., new
No. 4 Fosdick, 8" overarm, belted m.d., No. 2 Taper
1 mpindle Allen, belted m.d.
2 mpindle Allen, belted m.d., 8" overhang
No. 2 LMS Leland-Gifford, single spindle, High Speed,

m.d. 2 spindle Avey, size No. 1, type B, style VHP, m.d., 8"

2 spindle Avey, lass No. 1, type B, sayle virt, m.u., o overhang 2 spindle Avey, No. 2, 3 belted m.d., p.f. 2 spindle #2 Leland & Gifford High Speed, 8" over-hang, m.d. 3 spindle Leland & Gifford #1LMS—High Speed, late, m.d

mind spindle Leland & Gifford High Speed Model 3MS, m.d. spindle Allen High Speed, m.d. spindle Leland & Gifford High Speed, m.d. on each spindle spindle Leland & Gifford, m.d. on each spindle 7 Taper spindle Henry & Wright, m.d., 15" overhang, No. 2 Taper

HORIZONTAL DRILLS

HORIZONTAL DRILLS

away Nation Horisontal Drill, consisting of 3 E13 Holeunits

No ½8x30" Pratt & Whitney 2 spindle Deep Hole
Reaming Machine, m.d.

No. ½8x50" Pratt & Whitney Gun Barrel Rifting Machine, m.d., latest within 2 spindle Deep Hole Reaming Machine, m.d.

No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel
Rifting Machine, m.d.

No. 1 ½x1150" Pratt & Whitney 2 spindle Gun Barrel
Rifting Machine, m.d.

No. 1 Pratt & Whitney 2 spindle Deep Hole Drill,
belted m.d

Special Horis. Drill. Machine, Cintil. Bickford Head
Mounted horis. on base
Model 410 W.F. & John Barnes 2 spindle Hydraulic
Deep Hole Drill, m.d.

The above is only a partial listing WRITE FOR COMPLETE STOCK LISTING

EASTERN MACHINERY COMPANY

1006 Tennessee Avenue, Cincinnati 29, Ohio . MElrose 1241 . Cable Address EMCO

Additional equipment lines for industrial and power plant use wanted by manufacturers' representative for eastern half of Pennsylvania, southern half of New Jersey, and state of Delaware.

Write Box No. 689, MACHINERY, 93 Worth St., New York 13, N. Y.

PLANT ENGINEERS

To solve problems of heat transfer involving air, other gases and liquids, use the book, "Industrial Heat Transfer." Contains 123 working charts that give direct solutions quickly and accurately. 336 Pages., \$6.00 postpaid in U.S. The Industrial Press, 93 Worth Street, New York 13, N.Y.

Manufacturers Representatives

To represent large Mid-Western Manufacturer of ao represent large Mid-Western Manufacturer of speed reducing transmissions and cut gears of all types, on a commission basis, for territory of Detroit, Michigan or Birmingham, Alabama. Must be experienced in engineering and sales. All replies will be held strictly confidential. Box No. 688, MACHINERY, 93 Worth St., New York 13, N. Y.

MACHINE TOOLS

6' x 19" col. CARLTON MOTOR-ON-THE-ARM RADIAL DRILL. 48 spindle speeds, 10 to 1000 RPM. 20 HP. AC Motor Drive; Coolant System; RPM, 20 i Late Type.

FALK MACHINERY CO.

18 Ward Street - BA 5887 - Rochester, N. Y.

"LATE MODEL MACHINE TOOLS"

"LATE MODEL MACHINE TOOLS"
GRINDERS, CENTERLESS, No. 2 Cincinnati Filmatic
(2) 1942-1943,
GRINDERS, CYLINDRICAL, 4" x 18" Cincinnati Plain
byt. 1945,
GRINDERS, CYLINDRICAL, 6" x 18" Landis, 30"
Head, New 1941.
GRINDERS, CYLINDRICAL, 10" x 18" Cincinnati ER
HEAD, 1946.
GRINDERS, CYLINDRICAL, 16" x 72" Morten G,
wing 26", new 1945.
GRINDERS, CYLINDRICAL, 16" x 96" Landis type B,
48" pap. new 1941.
GRINDERS, CYLINDRICAL, 16" x 96" Landis type B,
48" pap. new 1941.
GRINDERS, SURFACE, 14" x 36" Pratt & Whitney
vert, sadd, 1942.
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary,
new 1947.
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary,
new 1946.
GRINDERS, TOOL & CUTTER, No. 13 Brown & Sharpe
universal, new 1942.
LATHES, ENGINE, 14" x 6" bed Hendey toolroom,
Timken, 1940.
24" x 48" Monarch, Toolroom, 1942
LATHES, ENGINE, 24" x 20" bed Leblond H.D. G.H.,
older.
LATHES, TURRET, No. 5 Jones & Lamson universal older. LATHES, TURRET, No. 5 Jones & Lamson universal (2), 1939. LATHES, TURRET, 36" and 42" Ballard New Era (2), 1939.
LATHES, TURRET, NO. 5 Jones & Lamson universal (2), 1939.
LATHES, TÜRRET, 36" and 42" Bullard New Era vertical.
MILL. 26" x 24" x 12' Ingersoil adj. raif, tracer, new 1945.
MILL, Nos. 3K and 4K Kearney & Trecker, rebuilt.
MILL, Nos. 3K and 4K Kearney & Trecker, rebuilt.
MILL, Nos. 24 and 5 Cincinnati Hi power piain.
PRESS, 105 ton No. 7½ Verson 081
PRESS, 105 ton No. 7½ Verson 081
PRESS, 100 ton No. 131 Cleveland 081.
PRESS, 100 ton No. 151 Cleveland 081.
PRESS, 100 ton No. 1546 Verson gap Frame, air clatch, 32 x 100 B.A.

- 4

19

79

WRITE FOR ILLUSTRATED CATALOG OF 1000

MILES MACHINERY COMPANY

2045 E. Genesee Ave. Telephone—Sagingw 2-3105 SAGINAW, MICHIGAN

BEFORE YOU BUY OR RENT

Consult INDUSTRIAL RENTING CORP.

Rent all the machine tools you need from ONE SOURCE with terms designed to

meet YOUR needs.

Our rates are as low as or lower than those offered by the government! Write for Brochure.

INDUSTRIAL RENTING CORP. 132 54 St. Bklyn, NY HY 2-6563



Twisted or broken tangs replaced at low costs on any tool with a Morse Taper (sizes 1 to 6) Hundreds of leading industries save money on drills, reamers, countersinks, cuttors, drivers, the NU-TANG way.

Prampt delivery, Send for prices—or send tools for repairs. All work guaranteed.

NO WELDING: NO SLEEVES!
NO SHORTENING: NO DISTORTION!
GUARANTEED
STRONG AS NEW!
We return them

us like this! * Patent No. 2,512,033 like this!

NU-TANGS INC.

1333 Bates Aven Cincinnati 25. Or







LUERS PATENTED CUTTING OFF TOOL HOLDERS

PATENTED CUTTING OFF BLADES
ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips.—MEANS MAXIMUM CUTTING EFFICIENCY.

J. MILTON LUERS, 12 Pine Street, Mt. Clemens, Mich.



MAX WYLER, Precision Levels

611 West 43rd St., New York 36, N. Y.

MACHINERY'S MATHEMATICAL TABLES

A special book containing 126 pages of the mathematical tables used daily in drafting-rooms and in many shops, including powers and roots of numbers, circumferences and areas of circles, functions of angles, and logarithms. The tables of squares, cubes, square roots, cube roots and reciprocals cover numbers from 1 to 2000. The tables of circumferences and areas are for diameters ranging from 1/64 to 100. The trigonometric functions advance by minutes and degrees and are given to five decimal places. All of these tables are also to five decimal places. All of these tables are the same as the ones in MACHINERY'S HANDBOOK, but this small book is especially adapted to continual usage and quick reference. Send your order and \$1.50 to

THE INDUSTRIAL PRESS, 148 Lafayette St., N. Y. 13



WOODRUFF FEATHER SPECIAL 30 years of customer satisfation based on a superior product, reasonable pricing, delivery dependa

delivery dependability, and company reliability. Always able to satisfy another

Write for literature

STANDARD AUTOMOTIVE PARTS COMPANY

TAPERED

ALSO Special Shapes machined from cold drawn atcel

> 667 NIMS MUSKEGON



LEWIS-SHEPARD

favors Faster Work Handling and gets it

with LELAND-GIFFORD DRILLING MACHINES

As manufacturers of materials handling trucks, Lewis-Shepard appreciates the value of efficient work handling in their own production. They use Leland-Gifford Multiple Spindle Drilling Machines to speed drilling, reaming, facing, deep hole drilling and tapping operations . . . to step up both the quantity and quality of work produced - to save the time and energy lost in working with less versatile machines.

With Leland-Gifford Multiple Spindle Drilling Machines the right tools for the job are always ready to use, in the combination and sequence called for, with the right speed accurately set and checked by convenient hand wheel and the Leland-Gifford Indicating Shift.

The complete line of Leland-Gifford Drilling Machines offers you a wide choice of machine sizes, number of spindles, swings and types of feed. If precision drilling is part of your business, you should have complete information. Write for it today.



LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

- e CHICAGO 45
 2515 West Peterson Ave.

 B DETROIT
- 10429 West McNichols Rd.

 CLEVELAND 21

- P.O. Box 217
 P.O. Box 217
 PEW YORK OFFICE
 75 South Orange Ave.
 South Orange, N. J.
 LOS ANGELES OFFICE
 2620 Leonis Blud, Veri
 INDIANAPOLIS 6
 P.O. Roy 1051

ALPHABETICAL INDEX OF ADVERTISERS

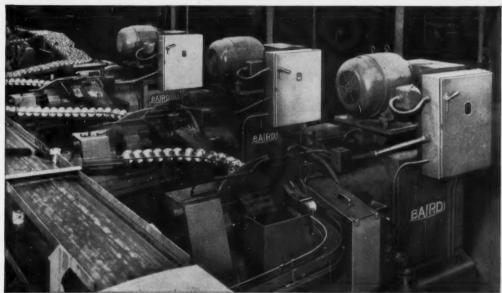
A	Classified Advts 400	Fosdick Machine Tool	Lapointe Machine Toul Co. 61 LaSalle Toul, Inc. 299
Abrasive Machine Tool Co 307	Clearing Machine Corp., Div. U.S. Industries, Inc. 79	Co. 316-317 Fulmer, Allen C. Co. 360	Le Blond, R. K., Machine
Abbey Etna Co 279	Cleereman Mch. Tool Co. 122-123	2 4111011 0: 00: 111111111111111111111111	Tool Co 01-00
Allegheny Ludlum Steel	Cleveland Crane & Engrg.		Lees-Bradner Co. 128 Leland-Gifford Co. 402
Corp 106 Alien-Bradley Co.	Co. 286 Cleveland Instrument Co. 322		Lempco Products, Inc 365
Insert bet. 44-45	Cleveland Punch & Shear	G	Lincoln Electric Co 390
American Brass Co. 327	Wks. Co 381	C-11 8 I 1 1 C- 930	Linde Air Products Co., Div. Union Carbide and Carbon
American Broach & Mach. Co Insert 87-102	Colonial Broach Co. 81 Columbus Die-Tool & Mch.	Gardner Machine Co 20-21	Corp 36
American Chain & Cable Co. 328	Co,	Giddings & Lewis Machine	Logansport Machine Co. Inc. 124
American Felt Co	Comtor Co	Tool Co 22-23	Lucas Machine Div., New
American Schiess Corp 78 American Sip Corp 291	Cone Automatic Mch. Co.	Gisholt Machine Co. Insert bet. 32-33	Britain Machine Co., The
American Steel Foundries 263	Consolidated Machine Tool	Gleason Works 117	Insert facing 110, 111-112-113
American Tool Works Co 135	Corp. 66-67	Goss & DeLeeuw Mch. Co 300	Luers, J. Milton
Ames, B. C., Co	Cosa Corporation	Grant Mfg. & Machine Co 397 Gray, G. A., Co 57	Luikiii Kuic Oo.
Armstrong-Blum Mfg. Co 288	Cross Company 253-254	Greenlee Bros. & Co.,	
Armstrong Bros. Tool Co 42	Crucible Steel Co. of America	Greenfield Tap & Die Corp.	
Automotive Service Tools Inc	Cumberland Steel Co 104	Insert 53	M
Avey Drilling Mch. Co 274-275			634
			Madison-Kipp Corp
			Materials Section 103-110
	D	H	Mattison Machine Works
В	Dalam Tarl & Washing Co	Hanchett Magna-Lock Corp. 306	Insert 87-102 McCrosky Tool Corp 308
Paind Machine Co	Dakon Tool & Machine Co., Inc. 398	Hannifin Corporation 309-380	Metal Carbides Corp 395
Baird Machine Co. Inside Back Cover	Danly Mch. Specialties,	Hardinge Brothers, Inc 140	Michigan Tool Co. 245
Baker Bros., Inc 287	Inc 68-69-285	Heald Machine Co. Inside Front Cover	Micrometrical Manufactur- ing Co
Ball & Roller Bearing Co 398 Barber-Colman Co. Insert 87-102	Davis Boring Tool Div. Giddings & Lewis Mch.	Heuser Manufacturing Co 399	Miles Machinery Co 400
Barnes Drill Co Insert 87-102	Tool Co 130	Hill Acme Co	Millholland, W. K.,
Barnes, John S., Co.	Davis Keyseater Co	Horsburgh & Scott Co	Machinery Co., Inc. 338- Mitts & Merrill 387
Barnes, W. F. & John Co.	Denison Engineering Co 349	Hydraulic Press Mfg. Co 353	Modern Industrial Engineer-
Insert 87-102	Detroit Broach Co 137	Hydro-Line Mfg. Co 392	ing Co
Baush Machine Tool Co 290	Diefendorf Gear Corp 398 Do All Company Insert bet. 70-71		Moline Tool Co
Bethlehem Steel Co 108-361 Bilgram Gear & Mch. Wks 399	Dreis & Krump Mfg. Co 397		Monarch Machine Tool Co.
Blanchard Machine Co 44	du Mont Corp 391	I	Moore Special Tool Co.,
Bliss, E. W. Co 62-63	Dykem Co 401		Inc 134
Brush Electronics Co 357 Bryant Chucking Grinder Co. 319		Illinois Gear & Machine Co. 313	Morris Machine Tool Co 297
Bryant Machinery &		Industrial Filtration Co 347 Industrial Press 371-377	Motch & Merryweather Mchry, Co
Engineering Co 122-123	E	Ingersoll Milling Machine	Mummert-Dixon Co 396
Buffalo Forge Co	E	Co Insert 87-102	
Bullard Co Insert 34-35	Eastern Mch. Screw Corp 396	Ingersoll-Rand Co 343	
Butterfield Div., Union Twist Drill Co 315	Eastern Machinery Co. 400 Edlund Machinery Co. 397		
Cition Twist Dilli Co 315	Eisler Engineering Co., Inc. 397		N
	Ekstrom-Carlson & Co.	j _	National Acme Co 37-45
	Elmes Engrg, Div. American	Jacobs Manufacturing Co 314	National Automatic Tool Co.
C	Steel Fdries 263	Johnson Bronze Co 393	Inc. 280-281 National Broach & Mch. Co. 325
	Engineering & Research, Div.	Jones & Lamson Machine Co.	National Tool Co
Carborundum Co.	ACF Industries, Inc. 282 Enterprise Machine Parts	354-355	National Twist Drill & Tool
Insert bet. 238-239 Card, S. W., Mfg. Co 295	Corp 401		Nebel Machine Tool Co 341
Carpenter Steel Co 110	Erie Foundry Co		New Britain Machine Co.,
Challenge Mchy. Co	oratory, Inc 369	K	The
Chambersburg Engrg. Co 80 Chicago-Latrobe Twist Drill	Ettco Tool Co., Inc	**	Insert facing 110, 111-112-113 New Departure Div. Gen-
Wks 340	Ex-Cell-O Corporation 249-269	Kaufman Mfg. Co 387	eral Motors 58
Chicago Pneumatic Tool Co. 256 Chicago Rawhide Mfg. Co 382		Kearney & Trecker Corp. 18-19 Kennametal, Inc. 116	New Jersey Gear & Mfg. Co. 398 Niagara Machine & Tool
Christensen Diamond		Kingsbury Machine Tool	Works 84-85
Products 324		Corp. 72-73	Nichols-Morris Corp 363
Cincinnati Bickford Tool Co. 241 Cincinnati Gear Co 384	F	Knapp, B. L. Industries 399	Norma-Hoffmann Bearings Corp. Front Cover
Cincinnati Grinders Inc 6-7	Fafnir Bearing Co. 48		Norton Company 14-15
Cincinnati Milling Mach.	Fairfield Manufacturing Co. 304		
Co	Falk Machinery Co. 400 Farrel-Birmingham Co., Inc. 359	L	
Co., Hydroform Div 71	Farval Corp 49	Control of the contro	
Cincinnati Milling Products	Federal Products Corp 75	L& J Press Corp 364	0
Div., Cincinnati Milling Machine Co	Fellows Gear Shaper Co. 4-5 Ferracute Machine Co. 383	Corp 126-127	Oakite Products, Inc 107
Cincinnati Shaper Co 76-77	Fischer Machine Co 398	Landis Machine Co 2-3	Ohio Crankshaft Co 43
Cities Service Oil Co 133	Foote-Burt Company 52	Landis Tool Co 10-11	Oliver Instrument Co 326

ALPHABETICAL INDEX OF ADVERTISERS

Olsen, Tinius Testing Ma-	Rockford Machine Tool	Sundstrand Machine Tool Co.	Viking Pump Co 38
chine Co	Co Insert 87-102	Insert 87-102	Virginia Gear & Machine
Onsrud Machine Works, Inc. 301	Rollway Bearing Co., Inc 373	Swanson Tool & Mch.	Corp. 33
Orban, Kurt, Co., Inc 78	Ross Operating Valve Co 261	Products, Inc 284	
Osborn Mfg. Co 60	Rowbottom Machine Co 387		
	Russell, Holbrook & Hender-	T	W
	son, Inc 125	1	The same of the sa
	Ruthman Machinery Co 386	m 6 m 1 M 6 . 1	Waldes Kohinoor, Inc 30
P	Ryerson, Joseph T. & Sons,	Taft-Peirce Manufacturing	Walker, O. S., Co., Inc 34
	Inc 142	Со	Walls Sales Corp
Pangborn Corporation 404		Texas Company 138	
Philadelphia Gear Wks., Inc. 335		Thompson Grinder Co 39	Waltham Machine Works 39
Pioneer Pump Div., Detroit		Timken Roller Bearing Co.	Warner & Swasey Co 24-23
Harvester Co 330	S	Back Cover	Wesson Company 26
Pittsburgh Plate Glass Co 379	3	Timken Roller Bearing Co.	Wheelock, Lovejoy & Co.,
Pope Machinery Corp 376	Scherr, Geo., Co., Inc 397	(Steel & Tube Div.) 105	Inc. 30:
Portage Machine Co 278	Scully-Jones & Co 366-367	Tomkins-Johnson Co 70	Wicaco Machine Corp 358
Potter & Johnston Co 121	Seneca Falls Mch. Co 46-47		Wilson Mechanical Instru-
Pratt & Whitney Div., Niles-			ment Div. American Chain
Bement-Pond Co 118-119	Shearcut Tool Co	U	& Cable 328
Procunier Safety Chuck Co. 395	Sheffield Corp. 129		Williams, J. H. & Co 342
	Sheldon Machine Co., Inc 368	U. S. Burke Machine Tool	Williamson Gear & Mch. Co. 398
	Shore Instrument & Mfg.	Div 375	Winter Brothers Co 16
-	Co., Inc. 398	U. S. Tool Company, Inc. 12-13	Wyler Max 401
R	Sidney Machine Tool Co 273	Union Carbide & Carbon	
	Simonds Abrasive Co 131	Corp., Linde Air Products	
R and L Tools 59	Simonds Saw & Steel Co 271	Co. Div	Y
Rehnberg-Jacobson Mfg. Co.	Sinclair Refining Co 132	Union Twist Drill Co 289	ı
Insert 87-102	Size Control Co 277	United States Drill Head Co. 120	37.1.0
Reid Bros. Co., Inc 352	Snyder Tool & Engrg. Co. 28-29	Universal Engineering Co 333	Yoder Company 38
Reliance Div., Eaton Manu-	South Bend Lathe Works 296	Used Machinery 400	
facturing Co 305	Stahl Gear & Machine Co 399		
Reliance Electric & Engrg.	Standard Automotive Parts	v	Z
Revere Copper & Brass, Inc. 267	Standard Electrical Tool Co. 372	*	7 7 1 7 999
Richard Bros. Punch Div.	Standard Gage Co., Inc 86	Valenite Metals Corp 311	Zagar Tool, Inc 323
	Standard Oil Co 114-115	Van Keuren Co 276	
Allied Products Corp 329	Standard On Co	Van Norman Co 8-9	
Rivett Lathe & Grinder, Inc. 136			CLASSIFIED SECTION
Rockford Clutch Div. of	Starrett, The L. S., Co 246	Verson Allsteel Press Co 294	
Borg-Warner 298	Sun Oil Co 243	Vickers Incorporated 331	See page 400







BAIRD Automatic CHUCKING MACHINES Join mass production lines at new FORD plant

The Baird Machine Company is pleased to share, with other manufacturers of modern automatics, in the high speed production at the Ford Motor Company's new Cleveland Engine Plant.

Shown above is a battery of Baird Chucking Machines. They completely finish-turn the engine piston, and finish the oil ring grooves to size. Machines are automatically loaded from the conveyor and automatically discharge the pistons when they are completed. Operations are fast, continuous, and to close-tolerance machining.

The Baird 76H Chucker (7"-chuck, 6-spindle, horizontal machine) combines, in a single automatic indexing cycle, such

operations as turning, facing, drilling, tapping, threading, grooving, and chamfering . . . if desired. Automatic electrical and mechanical safety devices prevent damage when setting up, when loading is not within cycle time, or when any motions are out of sequence.

Other valuable features are: easy access to all tooling, individual tool slides, individual spindle speeds, automatic chucking, maintained accuracy over a long service life.

If you require repetitive production of this nature . . . either hand load and unload, or entirely automatic . . . ask Baird engineers for details, Write Dept. M.

THE BAIRD MACHINE COMPANY

AUTOMATIC MACHINE TOOLS . AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES . AUTOMATIC PRESSES . TUMBLING BARRELS

Completely new Bullard Cut Master V.T.L. Model 75 uses TIMKEN® bearings to insure extra load capacity, top precision

O reduce power losses and provide highest efficiency at point of cutting, The Bullard Company engineers chose Timken® tapered roller bearings for the Bullard Cut Master Model 75, a completely new design of vertical turret lathes. Timken bearings are used in the table, headstock, feed and traverse mechanism, side, ram and turret head drives and other applications throughout the machine. They have been selected to meet the service requirements at each vital point with maximum efficiency. From 160 up to 196 Timken bearings are used according to the number and types of heads selected.

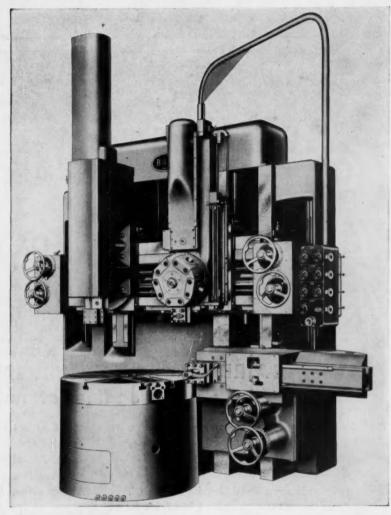
Timken bearings have extra loadcarrying capacity that results from line contact between rollers and races. Tapered construction permits preloading, so deflection is kept to a minimum, and constant accuracy is maintained. Radial and thrust loads can be carried in any combination. Timken bearings are geometrically designed to roll true and precision manufactured to live up to their design. They hold shafts in rigid alignment, insure accurate gear mesh.

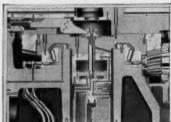
We take every step possible to make Timken bearings the best. We even make our own steel so we can control quality from beginning to end. We're the only U.S. bearing manufacturer that takes this extra step.

Make sure the machines you build or buy have bearings with the trademark "Timken". They're number one for value. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".



its bearings are the best





BULLARD design of table bearing construction uses Timken tapered roller bearings for long life, trouble-free performance.



TAPERED ROLLER BEARINGS



NOT JUST A BALL O NOT JUST A ROLLER O THE TIMKEN TAPERED ROLLER O

BEARING TAKES RADIAL (1) AND THRUST - (1) - LOADS OR ANY COMBINATION - (1) -

